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CO-OP ELECTRIFICATION ADVISER TRAINING OUTLINE

REA

RURAL ELECTRIFICATION ADMINISTRATION U.S. DEPT. OF AGRICULTURE

2-50

PURPOSES OF THIS OUTLINE

This is one of a series of outlines prepared by REA as an aid in planning and arranging training schools for co-op electrification advisers. Each outline deals with a power use subject or with some aspect of cooperative principles and practice or with a particular method or technique of getting information to people. These are the three principal fields in which electrification advisers need to be skilled. Each booklet contains both suggested subject matter and suggestions as to how the material might be presented, with an indication of a suitable time schedule. The booklet is thus useful as a guide to committees in charge of training schools, as an aid to the instructors, and as a subject matter manual that may be distributed to participants at the close of a training session for study and future reference. Subjects available or in preparation are listed below by title and number. *It is suggested that committees planning such training schools keep in mind the need of training in all three types of subject matter and, insofar as practicable, make use of the outlines in a balanced combination.*

LIST OF SUBJECTS

An ORIENTATION OUTLINE (unnumbered) covers all three fields of information. It is to provide the subject matter for an initial school that will give co-op officials basic background information and an understanding of the nature and scope of the educational job to be done.

NO.	POWER USE SUBJECT	NO.	CO-OP SUBJECT	NO.	METHOD OR TECHNIQUE
1	Farm and home Wiring	100	Value of Co-op	200	Getting News to Members
2	Farm Motors		Membership		(Newsletters and State
3	Water Systems and	101	Integrating Power		Paper Columns)
	Plumbing		Use and Co-op	201	Using the Radio
4	Electric Ranges		Education	202	Co-op Reports and Non-
5	Laundry Equipment	102	The REA Program		periodical Publications
6	Poultry Production		and Co-ops	203	Making Effective Talks
7	Refrigerators, Home	103	The Electric Co-op	204	Demonstration Techniques
	Freezers, Walk-Ins		— What It Is	205	Methods and Results of
8	Small Appliances	104	The Co-op Movement		Adult Education
9	Dairying		— Here and Abroad		
10	Pig Brooding	105	Co-op Bylaws	206	Effective Meetings
11	Farm, Home and	106	Establishing Member		
	School Lighting		Ownership	207	Photography and Motion
12	Farm Shop	107	Assuring Member		Pictures
13	Pump Irrigation		Participation	208	Working with Newspapers
14	Garden Watering	108	Co-op Tax Status	209	Exhibits and displays
15	Electric Hotbeds	109	Annual Meetings	210	Working with Rural Youth
16	Elevating, cleaning	110	Co-op's Place in	211	Working with Community
	and grading farm crops		the Community		Organizations
17	Drying grain, hay, peanuts, etc	111	Cooperation Between Co-ops		
18	Heating, cooling, ventilating				
19	Cleaners, dish washers				
20	Kitchen planning				

PROGRAM FOR POULTRY EQUIPMENT TRAINING SCHOOLS
FOR ELECTRIFICATION ADVISERS

FIRST DAY

Time	Subject	Instructor
8:30 A.M.	Registration	
9:00 A.M.	Introduction of Personnel	REA Fieldman
9:15 A.M.	Advantages and Disadvantages of Electrical Poultry Applications	Agricultural Engineer
9:45 A.M.	General Brooder Discussion	Headquarters Agricultural Engineer
10:15 A.M.	Intermission	
10:30 A.M.	Poultry House Lighting and Water Warming Principles	State College Representative
11:00 A.M.	Poultry House Ventilation, House Wiring, House Construction, and Litter Fundamentals	Agricultural Engineer (REA Fieldman, Headquarters or College Representative)
11:20 A.M.	Electrical Applications to Egg Production	Agricultural Engineer (REA Fieldman, Headquarters or College Representative)
11:40 A.M.	Poultry Debeakers, Pickers, Feeders, Radiant Heating, Feed Mixers and Grinders	Agricultural Engineer (REA Fieldman, Headquarters or College Representative)
12:00 Noon	Lunch	
	LABORATORY ACTIVITIES (All Instructors to Participate)	
1:00 P.M.	Brooder Inspection	
2:00 P.M.	Brooder Operation and Adjustment Answering laboratory questionnaires	
3:00 P.M.	Intermission	
3:15 P.M.	Brooder Operation and Adjustment Answering laboratory questionnaires	
5:00 P.M.	Adjourn for day	

SECOND DAY

Time	Subject	Instructor
8:30 A.M.	Discussion of Poultry House Equipment, including Lighting, Water Warming, Lamps, Time Clocks, etc.	Agricultural Engineer, REA Fieldman, Headquarters or College Representative
9:15 A.M.	Inspection of Above Equipment and Answering Questionnaires	All Instructors to Participate
10:15 A.M.	Intermission	
10:30 A.M.	Discussion and Inspection of Poultry House Ventilation and Answering Questionnaires	All Instructors to Participate
12:00 Noon	Lunch	
1:00 P.M.	Discussion of Electrical Egg Production Equipment	Agricultural Engineer from College or REA
2:00 P.M.	Laboratory Inspecion of the Above Equipment and Answering Laboratory Questionnaires	All Instructors to Participate
3:00 P.M.	Intermission	
3:15 P.M.	Operation of Equipment	All Instructors to Participate
5:00 P.M.	Adjourn for day	

THIRD DAY

8:30 A.M.	General Presentation of Operating Principles of large Equipment, including Feed Grinders, Mixers, Feeders, Scalders, etc.	Agricultural Engineer from REA or College
9:15 A.M.	Laboratory Operation and Adjustment of Equipment	All Instructors to Participate
10:15 A.M.	Intermission	
10:30 A.M.	Answering of Laboratory Questionnaires	All Instructors to Participate
11:30 A.M.	Discussion of Costs, Earnings, and Other Factors in Use of Electrical Poultry Equipment	Agricultural Engineer, REA or College
12:00 Noon	Adjourn Poultry School	

INSTRUCTIONS ON PROCEDURE IN POULTRY TRAINING PROGRAM

First Day - 9:00 A.M.

Display of Equipment

Place as much of the poultry equipment as possible in neat display before the group. It should be arranged in the order of its customary seasonal farm use, beginning with the brooder which would ordinarily be in use from January to May. Place the brooder so that it is facing the group at its left. Stand all the brooders on edge so that the interior parts, including the heating element, thermostat, pilot light, thermometer, and circulating fan, if any, are clearly visible. The following list of equipment should be arranged in order, extending across the display area from left to right:

1. Brooders with
    a. Glowing type heating element
    b. Black heat element
    c. Electric lamp heated brooders
        (1) With heat lamps
        (2) With incandescent lamps
    c. False floor for brooder (homemade)
2. Insulated (box type) water warmer
3. Automatic feeder
4. Feed grinders
5. Feed mixers
6. Chicken pickers
7. Poultry house ventilating fans
8. Electric scalding equipment

Obtain a table approximately 3 by 5 feet and place it in the center of the display. The large equipment should be on each side of the table and the small equipment should be placed on the table. From left to right the following equipment should be shown on the table:

1. Wafer type thermostat and micro-switch
2. Brooder heating elements
    a. Coiled wire heating elements
    b. Black heat elements
        (1) Straight bar type
        (2) Circular type
    c. Heat lamps and incandescent lamps
3. Miscellaneous brooder parts
    a. Samples of insulation
    b. Circulating fan
    c. Brooderator (if available)
    d. Thermometer

4. Poultry house lighting equipment
   a. Light reflectors - RLM 14 inch shallow
   b. Time clocks
   c. Electric lamps - various kinds
5. Water heating equipment
   a. Immersion type heater
   b. Lamp type heater
      (1) Immersion type (homemade)
      (2) Lamp under bucket (homemade)
6. Egg candler
7. Egg cleaners
   a. Brush or sandpaper type
   b. Sand or emery paper on grinder stand spindle (homemade)
8. Debeakers
9. Various lamp types
   a. S-1 sun lamp - mogul base
   b. S-4 sun lamp - medium base
   c. Heat lamp - medium base
   d. Incandescent lamp - medium base
   e. CX lamp - medium base

The morning session of the first day should be taken up with a discussion of all of the equipment on display. Brief remarks on each piece of equipment, as to its purpose, operation, characteristics, etc., should be given in order to give the advisers an over-all picture of the great variety and the uses of poultry equipment available.

First Day - 1:00 P.M.

The afternoon discussion and laboratory period should be concentrated on the various types of brooders, the operation and adjustment of the various parts, and the general operating characteristics of electric brooders. Several brooders, ranging from the homemade incandescent lamp heated type to the more complicated commercial models, should be available and all in working condition. Each group of students should be assigned to a particular brooder and should be responsible for putting it into operation. Thermometer readings should be taken, adjustments made of the thermostat, circulating fans, and other special features operated so that each person is thoroughly familiar with the handling of the brooder.

If possible, 50 or more chicks should be obtained from a local hatchery and placed under one of the brooders so that the advisers can see the steps which are taken to start the brooding operation. A protective fence should be placed around this brooder to confine the day-old chicks.

As the students in each group have time to familiarize themselves with the brooder assigned to them, they should be moved to the next one so that they have the opportunity to become thoroughly

familiar with all of the brooders on display. Each student should fill out the questionnaire on brooders for all the brooders shown. The advisers should be encouraged to ask questions and to compare the brooders critically; that is, the construction details, insulation, electrical heating elements, and cost.

Second Day - 9:00 A.M.

The morning discussion should be concentrated on poultry house lighting and on electrical laying house equipment, including night lighting and water warming equipment. Lighting elements, including various sizes and types of lamps, time clocks, RLM reflectors, etc., should be carefully examined and their principal features discussed among the students themselves and with the instructor.

Second Day - 11:00 A.M.

Poultry house ventilation should be taken up and presented to the group as a whole. Emphasis should be placed on the automatic operation of the fans, their capacity to move air, the operation of the humidistat, temperature limitation control, and a combination control of humidistat and thermostat to obtain desirable moisture and temperature controls.

Second Day - 1:00 P.M.

The afternoon discussion and laboratory period is to take up miscellaneous equipment, including the debeaker, egg candlers, egg cleaners, egg graders, egg coolers, and poultry pickers. Again the general plan of having each of the advisers work with specific equipment in groups and moving from item to item should be followed. Questionnaires should be filled out for each item and the students should become thoroughly familiar with the operation of equipment on display. Poultry pickers and debeakers should be operated, one bird for each person being available. A live bird should be debeaked by each person. The birds should be killed and picked on the poultry picker, each person becoming thoroughly familiar with this operation.

A sufficient number of eggs should be available so that the egg candlers, egg cleaners, egg graders, and egg coolers can be operated. It will be necessary to use the entire afternoon in conducting these activities.

Third Day - 8:30 A.M.

The morning period should be given over to the larger equipment, including automatic poultry feeders, feed mixers, and feed grinders. At least two models of each of the heavier pieces of equipment

should be available if they can possibly be obtained, so that each adviser group can work without interference. If too many individuals are assigned to one machine, little is accomplished. Again questionnaires should be filled out and the students should be encouraged to operate the equipment. If possible, each group should grind a small amount of feed. If the Viking unit is available, an overhead bin should be provided and automatic grinding conducted during at least part of the laboratory period. After two or more kinds of feed have been ground, they can then be placed in the mixer and operation of the mixer demonstrated.

It will probably not be possible to have a complete automatic poultry feeder, but enough of the working parts should be obtained so that the advisers can become thoroughly familiar with the general operating procedure in using this equipment. If a complete unit can be obtained, the men should be directed to assemble the machine and put it into operation.

ELECTRICAL POULTRY APPLICATIONS

October 1, 1949

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PURPOSE OF THIS BOOKLET

This booklet has been prepared to acquaint the electrification advisers employed by REA cooperatives with the electrical poultry equipment suitable for farm use and now on the market.

No attempt has been made to discuss or treat poultry management as such. Good poultry management practices vary in different sections of the United States. Electrical equipment is supplementary to management. When properly used, it will improve the results of good management. Without good management, electrical equipment can be of little or no value.

ELECTRICAL POULTRY APPLICATIONS

March 1, 1950

I INTRODUCTION

In 1940, sixty-seven percent of the farms in the United States reported poultry production. Electrical poultry applications are a source of revenue important to all cooperatives. In general, 80 to 90 percent of farmers in the northern states keep some poultry. In the southern states most poultry production before the war was in the hands of comparatively small commercial producers in rural areas. As a result, there are thousands of southern farms which have no chickens. Poultry products in the South are generally imported in considerable quantity because there is not sufficient production within the state to supply the demand. During the last war, more poultry was produced all over the United States than ever before. Much of the production increase in the South came from the establishment of comparatively large commercial poultry farms. The area around Gainesville, Georgia made an outstanding increase, becoming one of the three largest broiler districts in the country.

Today, there are still many southern states which import the major portion of the poultry and eggs consumed within the state. In the Cotton Belt, census records show that in many areas less than one percent of the gross farm income is from poultry. This is of importance because the situation indicates that many farmers could profitably enter the poultry field. The farmer who wishes to start a poultry enterprise or to specialize in poultry production should first determine whether he can market his products locally on either a wholesale or retail basis. If not, then a suitable market must be located before money is invested or production started.

The electrification adviser may discover that many farmers are eager to diversify their production and are willing to start a poultry enterprise because of their need for new farm income. If such is the case, considerable investigation should be made before any great number of members get into the business. County agents, state college poultry specialists, local cooperative poultry marketing agencies, and commercial buyers should be consulted as to the probable future of the local poultry and egg market. It is always safer for the adviser to recommend the use of electrical poultry equipment to established producers rather than to encourage an inexperienced member to enter a poultry production activity.

Any program to promote the use of electrical poultry production on individual farms will be an improvement in the farming program of such areas. In the northern states much of the increased poultry production came from the increased size of individual flocks. The size of the flocks may be reduced as the post-war demand is lessened, but the use of electricity in poultry production should be expanded in most areas.

The use of electricity in production can be extremely favorable to both northern and southern poultry producers, but it should be thoroughly understood that electricity does not substitute for any of the better poultry management methods. Electricity, plus good management, can be very profitable. Without good management practices, the farm poultry enterprise will probably be a failure with or without electric power.

Electric incubators both large and small have been developed for hatching chicks, but electrification advisers should not recommend the use of such equipment for the farm. The farm practice of purchasing day-old, disease-free chicks from high producing parent flocks, supplied by approved hatcheries has been well established. Since most farmers do not have the time or facilities for testing the parent flocks for disease or to trap-nest them for production, they should make no attempt to hatch their own chicks. This service should be obtained from the local hatchery men or breeder hatchers who have established their reputation for producing high quality, disease-free birds. In many cases hatcheries guarantee 100 percent live delivery by mail and 90 percent livability up to two weeks of age. Farmers using day-old chicks and using proper management methods, together with electric brooders, should raise from 90 to 95 percent of the birds purchased. (See REA homemade brooder plans.)

Hatching chicks from farm-produced eggs is risky business. Losses of 40 to 50 percent or more are not uncommon when hatching eggs from diseased hens are used. Greatest losses are caused by white diarrhea (pullorum disease), which is transmitted from the hen to chick through the egg. Commercial hatcheries have each hen in the laying flock tested and all hens reacting unfavorably to the pullorum test and the eggs they laid are disposed of. The best hatcheries sell chicks guaranteed to be from eggs laid by pullorum-free hens. When chicks are obtained from laying stock, approved hatcheries can show the egg laying records of the parent stock. No farmer can afford to run the risk of hatching his own eggs unless the laying flock is tested at regular intervals and all hens that react to the disease tests discarded. This is too much detail for the farm-sized flock and requires trained poultrymen to follow the procedure. Consequently, the purchase of quality chicks from reliable hatcheries should be recommended to farm people.

In some cases poultrymen producing standard bred flocks may have need for small incubators. Inquiries about such equipment and for large commercial incubator installations should be referred to the poultry department of the state college.

Electrical poultry applications can be made to increase profits. Outstanding advantages include reduced labor, increased production, reduced costs, higher quality products, timely seasonal egg production, ventilation of houses, feed processing, dressing facilities, and the use of refrigeration for either cooling or freezing the marketable products.

Many electrical poultry installations are low in first cost and bring noticeable results within two weeks' or a month's time on limited use of electricity. Frequently advisers will find that a few simple and successful electrical poultry applications can be the means of interesting members in other applications. Nothing succeeds like success and the farm family that makes a few successful electrical applications will rapidly learn to think in terms of electric power when planning their farm work.

II ADVANTAGES AND DISADVANTAGES

A. Advantages of Electric Brooding to the Poultryman
   (1) Practically no fire hazard
   (2) Permits cold house brooding
   (3) Reduces labor and attention
   (4) Eliminates overheating and suffocation of chicks
   (5) Produces early feathering, lively chicks
   (6) Reduces mortality

B. *Disadvantages of Electric Brooding to the Poultryman
   (1) Current outages
   (2) Moisture condensation under brooder

C. Advantages of Electric Brooder Operation to REA Cooperatives
   Normal brooder operation on the average REA member's farm is of special value to REA because of its seasonal effect on the system load. The project that has a high brooder density among its members will discover that the brooder load tends to maintain the average load during the spring. This may prevent a large valley from occurring in the annual load curve. This valley would normally develop because of the farmers' increased outdoor activities from March to June and the subsequent reduction in use of power for lighting and radios. In June, refrigerators begin to use more power and the load curve begins its annual climb, reaching its maximum in kilowatt hour consumption in the fall and winter. Projects highly saturated with brooders have a very limited or no billing reduction in March, April, and May.

*See explanation and remedies for disadvantages.

Another advantage of the brooder load is that it is primarily a night load, consuming more electric current during off-peak hours than it does during the daytime in general. This is due to the fact that the coldest temperatures of the day occur at night in normal spring weather. The electric brooder is a real contribution, both to the welfare of the farmer member and his cooperative.

D. Poultry Management Fundamental to Success

There are at least six fundamental principles of poultry management which must be observed before any success can be expected. These are as follows:

1. The selection of high quality chicks, from pullorum-free parent flocks.
2. Adequate supply of balanced ration for growing and laying flocks.
3. Adequate and continuous supply of water.
4. Rigid culling at regular intervals.
5. Weather-proof housing, of adequate capacity.
6. Rotation of range to prevent diseases.

There are other important phases of poultry management, but when the above requirements are met, at least the foundation has been laid for a successful poultry business. Electricity can make many contributions to increasing production, decreasing costs, and increasing income. These applications include electric brooding, night lighting, water warming, chicken feeding, feed grinders, ventilation, egg grading, egg candling, egg cleaning, egg cooling, and freezing of poultry products.

E. Breeds of Poultry

The most common poultry breeds found on the farm include the White Leghorn, the New Hampshire, the Rhode Island Red, the White Rock, and the Barred Plymouth Rock. There are many other breeds but they are less frequently kept on the farm.

Leghorns, New Hampshires, and Rhode Island Reds are generally raised for egg production because of their ability to lay heavily when properly cared for. Other breeds are a combination of egg production and meat production. The New Hampshire is a new breed of chicken recently established and officially recognized only a few years ago. It is noted for its strength, vigor, and long life. The New Hampshire breed and crosses of these birds with other breeds are very popular for broiler production

Leghorns are not so popular in some farming areas because poultry buyers discount the price per pound they pay for them.

The heavier breeds bring premium prices for meat, which offsets the cost of the feed to produce and maintain the bigger birds. Some strains of heavy breeds are good egg producers and frequently win egg laying honors. In many areas, however, it is generally throught that on the farm greater egg production is obtained by keeping Leghorns. Community experience and the availability of egg or meat markets determine whether egg, meat, or combination egg and meat breeds are to be kept.

III BROODING

A. Brooder Design and Construction

Hover type electric brooders are so designed and insulated that the heat is confined within the hover. This reduces the consumption of current to a minimum and makes the operation of the brooder very economical. Generally from one-half to three kwh per chicken for an 8-weeks brooding period is all that is required, the amount depending upon the time of year and the climate. Some manufacturers use insulating board to prevent heat from escaping from the hover. Others use a dead air space or cover the top of the brooder with insulating material. If the brooder is flat and recessed like the REA homemade brooder, various insulating materials such as chopped straw, ground corn cobs, oat hulls, and cotton seed hulls available about the farm may be used. Brooders made of wood generally have enough insulating effect so that they do not require additional insulating material. Sheet metal brooders generally require at least a half-inch of insulation board or varying thickness of other insulating material for economical operation.

The chicks provide some of the heat under the brooder. Insulating the brooder not only helps to save electric power consumption, but it also protects the chicks during current failure. The natural heat generated by the chicks after they are 10 days to 2 weeks of age will help prevent severe losses during most current outages when insulation is used.

The brooder should be well constructed and of good quality materials. The legs should be adjustable to permit lowering or raising the hover for very young or partially matured chickens. If possible, some means should be provided to prevent or discourage birds from roosting on the top of the brooder. Low roosts placed near the brooder will encourage the young birds to roost at an early age and tend to keep them off the brooder.

B. Brooder Heating Elements

There are several types of brooder heating elements, including coiled incandescent wire, a black heat element, and various types of electric lamps. Brooder elements range from 500 watts to 1000 watts, depending upon the size and capacity of the brooder.

(1) Coiled Wire Elements

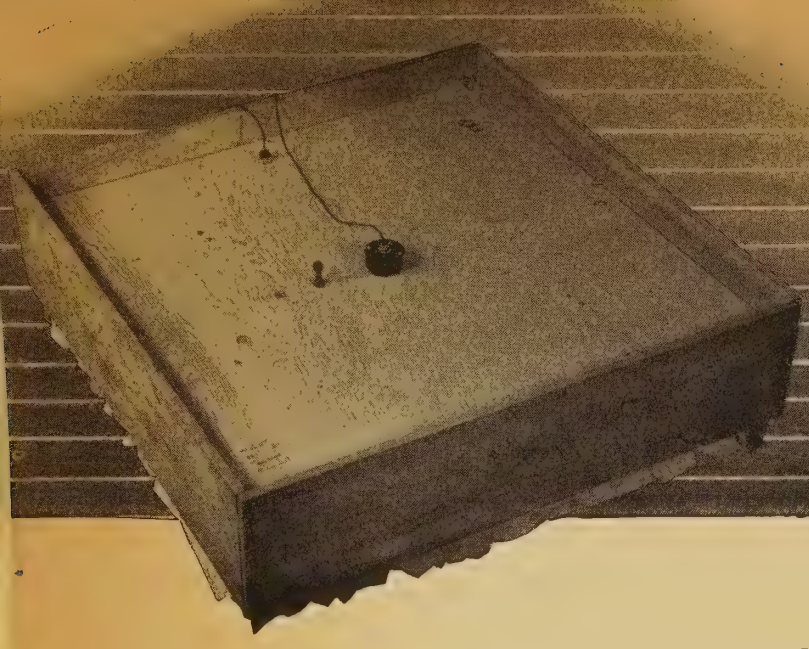
Coiled wire heating elements are not considered as desirable as other elements because the wires get red hot and may burn the chickens or start a fire, if trash is scratched into contact with them. For this reason, practically all coiled wire units are protected by a reflector with open mesh wire beneath. Such units are controlled by the wafer type thermostat satisfactorily.

(2) Black Heat Elements

Black heat elements consist of a strip of metal, circular or straight in shape. These units are formed around a core of fire-proof materials in which are imbedded heating coils. Such units do not become hot enough to glow as do the exposed coiled wire elements. Non-glowing units are not as dangerous to chicks and are practically incapable of starting a fire. They prove very satisfactory, especially when used with a bright reflector which throws all the heat downward on the chicks. The wafer type thermostat is very satisfactory for controlling the temperature within the hover for this type of unit. Brooder equipment with a black heat element is generally more expensive than those with open coiled wire heating elements.

(3) Lamp Heated Brooders

During the war, metals used in making coiled wire and black heat brooder elements were very scarce. Consequently various types of electric lamps were used as a substitute. (Be sure to see the REA plans for a homemade brooder. If possible, get every cooperative to build and display the homemade lamp heated REA brooder). It has been determined that the average incandescent lamp releases 90 to 92 percent of the energy passing through it as heat and the balance as light. This makes a very acceptable unit for brooding chickens. Lamps were readily available all through the war, and they gave unusually good results with chickens. This is partially due to the fact that brooders heated with lamps are well lighted and this gives the chicks additional protection from crowding and smothering.



for successful chick brooding . . .

A HOME-MADE ELECTRIC BROODER

Questions and Answers on Your Brooder

Q. What are the advantages of a lamp-type brooder?

A. Lamp brooding is a near approach to natural brooding conditions. Lamps do not heat the entire brooder house. Therefore their use permits a natural zone of cool air away from the brooder. By moving from the heated air under the brooder to this cool zone at will, chicks become adapted at an early age to changing temperatures, and thus become more hardy.

Q. What about heating elements and thermostats, as recommended in earlier brooder plans?

A. Some thermostats do not operate satisfactorily with incandescent lamps. To prevent trouble and save critical material, thermostats and strip heaters are not used.

Q. Some brooders use four lamps. Why only two?

A. Use of 2 lamps simplifies wiring, uses less material. Four may be used.

Q. Why can't I use one double-size lamp?

A. One lamp may burn out. Two are not likely to fail at the same time.

Q. At what temperature should I keep the brooder?

A. Your county agent can advise you on temperatures needed for the various ages of chicks. Lamps should be replaced by smaller ones if temperature is too high.

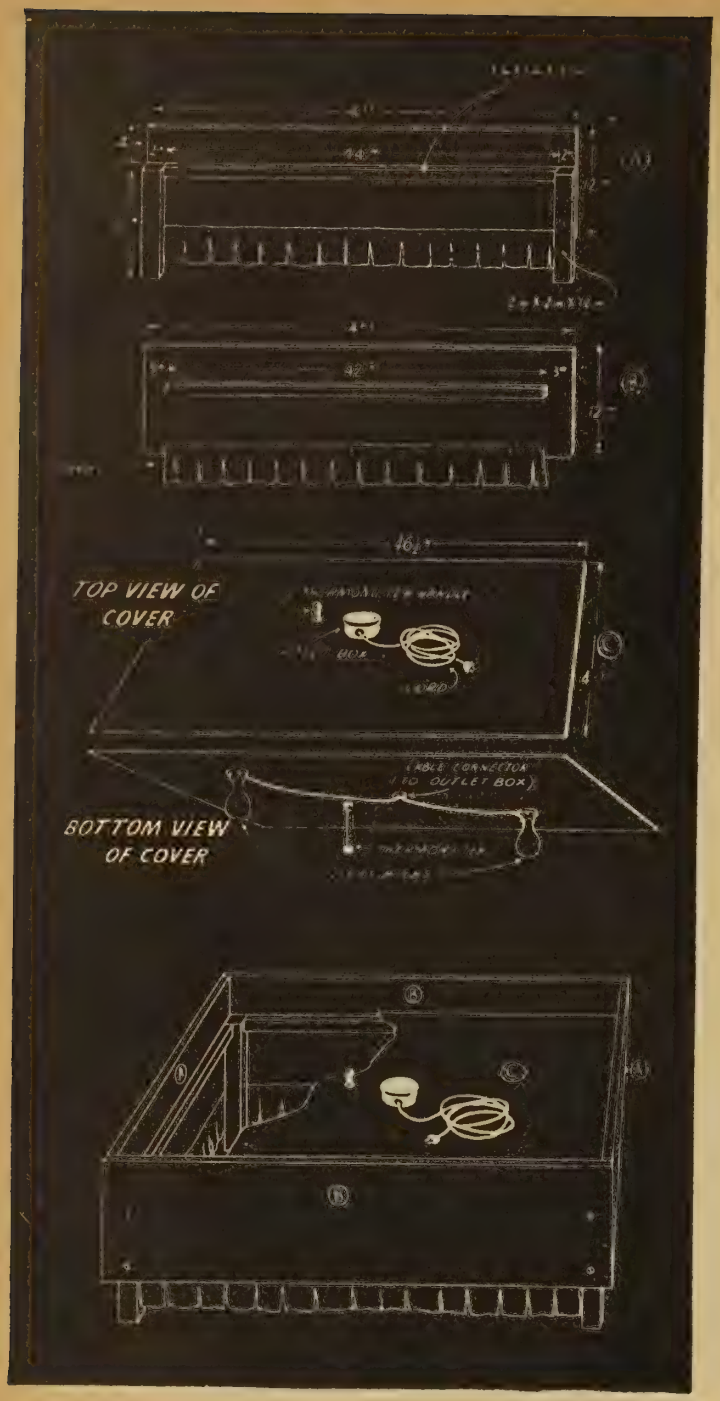
Make Your Own...

An electric brooder saves time and labor.

Saves more chicks by reliable heat control, thus preventing feed loss. Replaces laying hens lost in fall and winter.

Offers low-cost production—more cash income.

Rural Electrification Administration
U. S. Department of Agriculture
Washington 25, D. C.



Assembling the Brooder

First, cut cover piece as indicated. Cut other lumber to size. Then assemble pieces as indicated in diagram. Use shingle nails, and secure with screws for additional strength. Nail support for cover along sides as indicated Next, locate the center of the cover by drawing diagonal lines from opposite corners. Bore a ¾-inch hole at the center, and two ¼-inch holes at either side, to accommodate the outlet box. Attach the box by stove bolts. Fit one cable connector in knockout opening in bottom of outlet box. Fit the second cable connector in the sides or top of outlet box as desired.

Bore two ¼-inch holes to fit light receptacle openings, half way between the outlet box and the respective corners. Bolt receptacles to cover. Bore another ¾-inch hole at one side of outlet box to hold the thermometer.

OBTAIN THESE MATERIALS:

Lumber	Cut to:	Use
Two pieces, 1" x 12" x 8 feet	Four pieces, 1" x 12" x 4'	Sides
One piece, 2" x 2" x 4 feet	Four pieces, 2" x 2" x 12"	Legs
One piece, 1" x 4" x 4 feet	Two pieces, 1" x 1" x 44"	Support for cover
	Two pieces, 1" x 1" x 42"	
One piece, ¼" x 4' x 4' of plywood, wallboard, or any light, rigid and damp-proof material as available.	¼" x 4' x 46½" (One and one-half inches off one side)	Cover

Electrical Supplies

One 12-foot extension cord and male plug	
Two porcelain lamp receptacles (covered terminal type)	Hold lamps
Six electric lamps (two each of 200, 150 and 100 watts—or as needed)	Heaters
Two one-half inch cable connectors	Hold cord fast in outlet box openings
One four-inch metal outlet box and top	Protects splice in cord
Six-inch strip of friction tape*	Tape wires in outlet box
Six-inch strip of rubber tape	Tape wires in outlet box

Miscellaneous

24" x 36" strip of heavy cloth or Six pieces, 4" x 36" canvas	Side canopies
One brooder thermometer	
¼ lb. shingle nails	Fasten canopies to sides
1 box wood screws 1½" No. 6	
1 box carpet tacks	
Six ¼-inch by one-inch stove bolts and nuts (screws may be substituted)	Fasten electric fixtures to cover

* Wire should be soldered or clamped before taping.

Attach cloth or canvas canopies, with bottom edge cut to permit small chicks to pass in and out readily.

A spool or two attached to the cover will serve as handles for raising.

When the brooder is in use, chopped hay or straw, ground-up corn cobs, cottonseed hulls or other insulating material should be piled on the cover, level with the top of the sides.

How Much Power?

Amounts of power used to brood 250 chicks for a six-week period with this two-lamp brooder will vary according to weather conditions in various areas. The thermometer will be used to determine when bulbs of lower wattage may be substituted. A *maximum* power demand may be calculated as follows:

Two weeks (14 days) with two 200-watt lamps =

$$\frac{14 \times 24 \times 400}{1.000} = 134.4 \text{ kwh}$$

Two weeks with two 150-watt lamps =

$$\frac{14 \times 24 \times 300}{1.000} = 100.8 \text{ kwh}$$

Two weeks with two 100-watt lamps =

$$\frac{14 \times 24 \times 200}{1.000} = 67.2 \text{ kwh}$$

Total____ = 302.4 kwh

$$\frac{302.4 \text{ kilowatt hours}}{250 \text{ chicks}} = 1.29 \text{ kilowatt hours per chick over the six-week period.}$$

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So far as is known, there is no experimental data indicating that the lamps produce better results than other types of heating elements, but reports were unusually good on the success obtained with them by farmers.

Generally lamp sizes are varied with the age of the chicks and the temperature occurring during the brooding season. As a rule, two 200-watt lamps are used for the first week in a 4' x 4' brooder (250 to 300 chick capacity). Thereafter lamp sizes are reduced each week by 50-watt steps until at eight weeks only 50 watts of light are in use. This is accomplished by replacing each lamp with a 50-watt smaller size lamp each week or ten days until the last step, when two 25-watt lamps replace the two 50-watt lamps in the brooder. It is thought necessary that two lamps be used all the time in case one should burn out. It is very unlikely that both lamps would burn out together, and this would insure some light and heat in the brooder at all times. When properly done, exchanging lamp sizes keeps current consumption below one kwh per chick in mild weather climates or late spring.

Wafer type thermostats are not used with incandescent lamps because they do not perform satisfactorily. This is very important, and no attempt should be made to use wafer type thermostats with lamp heated brooders. This is due to the fact that the sudden surge of current when the lamps are lighted has a tendency to stick the thermostat points, thus preventing their operation. Sometimes thermostats used with lamps stick in the off position, thus leaving the chicks without heat. Such difficulties with the thermostat are not experienced with brooders using coiled wire or black heat elements.

In some cases, infra-red or heat lamps are used in place of the incandescent lamps. One objection to the use of such lamps is their scarcity in many rural communities. They may be difficult to locate, and to date the smallest size in which they can generally be purchased is 125 watts.

Infra-red heat lamps are desirable for hoverless brooding but incandescent lamps give excellent hover-type brooding results. Either inside-frosted lamps or reflector flood lamps may be used in a hover-type brooder. Reflector lamps are made in 150 and 300 watt sizes only. Therefore the incandescent lamp which can be obtained in a wide variety of wattages is most generally desirable

for electric lamp-heated, hover-type brooders. (Incandescent lamps suitable for brooders range in size from very small to very large wattages by steps, ie, 7½, 15, 20, 25, 40, 60, 75, 100, and 150 watts.)

The bright light under lamp-heated brooders is not harmful to the chickens' eyes. Light meters indicate that the light under such brooders is far less than the sunlight on a bright, sunny day. Sometimes very young chicks have to be coaxed out from under brightly lighted brooders. This is done by placing feed containers partly under the brooder and water containers just outside the hover. These methods help to get the chicks outside and once they learn to leave the brooder the feed and water containers can be moved back a little farther each day. Soon the chicks will run in and out at will. In some cases colored lamps are used to reduce brightness but this is not necessary. Some people think that red lamps help to reduce cannibalism especially with white chickens because red lamps make blood spots appear black. If cannibalism develops red lamps could be tried but a better method is to debeak the birds with an electric debeaker

There is another method of using heat (infra-red) lamps for brooding either chickens or pigs without the use of of hover or enclosure of any kind. This is done by hanging the lamp above the brooding area. The light and infra-red rays (infra-red rays are invisible) respectively attract and warm the chicks or pigs. Special care should be taken to prevent drafts from the brooding area or building since there is no protective cover for the chickens or pigs. Another disadvantage of this method is the lack of an insulated area to store and conserve heat in case of a current outage. As previously stated, chickens 10 days to 2 weeks of age begin to produce enough heat to help maintain brooder temperature in case of a current outage. It is essential to have a small insulated space to confine and conserve this limited amount of heat. In the open brooder area the heat immediately dissipates because there is no way of confining it.

C. Germicidal Lamps in Brooders

Since the war some manufacturers place a germicidal lamp in the brooder to reduce air-borne diseases. This increases the cost of the brooder considerably. When germicidal lamps are used in poultry houses and brooders, they should be shielded to protect both the chickens' and the poultryman's eyes. Shielded lamps should be provided with a fan or other method of circulating the air past the lamp to kill the disease germs effectively. To date the Beltsville Agricultural Research Station has not recommended the use of germicidal lamps.

Experiments at the Beltsville, Maryland Agricultural Research Station indicate that the settling of dust on germicidal lamps reduces their effective germicidal power almost immediately. Since poultry houses are nearly always very dusty, the effectiveness of the lamps is greatly reduced. The dust particles prevent the ultra-violet rays from striking germs. Dust particles are very large in comparison with germ and bacteria size. Thus ultra-violet lamps fail to kill all the germs because of the light shadows caused by the dust in the air and on the lamps.

D. Brooder Costs

Commercial brooder costs range from $20 to $75 for a 300-chick size brooder, the amount depending upon the quality of the construction, the type of heating element, and the number of gadgets added to the brooder. Five hundred-chick brooders cost up to $100 when equipped with germicidal lights. Lamp-heated brooders can be made at home at a cost of about $10 for the 300-chick capacity. REA provides plans for the construction of such a unit. Smaller or larger size brooders may be constructed or purchased. As a general rule, it is recommended that not more than 300 chicks be brooded under one hover in farm production. Consequently, construction details and purchase price for the larger brooders should be of little interest.

E. Capacity of Electric Brooder

Manufactured electric brooders vary in size from 50 to 500 chick capacity. The general tendency is to standardize brooders sold for farm use at 300 and 500 chick sizes. Standard dimensions of these two sizes of farm brooders are approximately four feet square and four feet by eight feet. Round brooders vary from four to five and one-half feet in diameter. Some manufacturers tend to overrate the capacity of electric brooders in their zeal to sell equipment; that is, a brooder suitable for 250 chicks is frequently rated as a 300-chick brooder. This may not be particularly serious with chicks less than two weeks of age. As they grow, chickens in over-rated brooders are crowded. When unfavorable weather conditions or panic develop, this may result in smothering and trampling.

The lighter breeds of chickens, such as Leghorns, should be provided with seven square inches of space per bird, and the heavier types of birds, nine to twelve square inches each. It is also desirable to have at least nine square inches per poult for turkeys in electric brooders, and some authorities recommend fourteen square inches of space. Others recommend twenty square inches each. Space requirements for brooding vary with the time of year and the latitude where they are raised. Space requirements may increase with the age of the birds. See "Brood Healthy Chicks with Electricity", Extension Bulletin No. 111, Mississippi State College, State College, Mississippi.

The use of all-night lights in brooder houses is good insurance. Light at night permits chicks to eat any time. This reduces the number under the hover at any one time, which is always desirable because it increases the area per chick for those under the brooder. Light also tends to prevent panic and the resultant crowding, smothering, and trampling.

F. Brooder Ventilation

As discussed elsewhere, the heating of brooder houses causes condensation of moisture on the walls and the floor in cold weather. The electric brooder does not warm the house because it is insulated to confine the heat. Consequently, condensation difficulties tend to be reduced. In extremely cold or damp climates there is a tendency for moisture to condense on the floor immediately beneath the hover. For this reason, manufacturers of electric brooders have equipped their products with ventilating devices. The most simple method consists of an opening near the top of the brooder, the size of which can be adjusted by a movable cover. This is known as a vent or port. The more elaborate brooders contain small electric fans with more or less complicated systems of recirculating the air through the brooder. Only a small portion of the total amount of air circulated per minute is permitted to escape. If the entire capacity of the fan were used in removing the air from the brooders, the temperatures would be lowered excessively and the costs of brooding would be much greater.

There is a tendency on the part of the manufacturers to over-rate the importance of forced ventilating under the hover. It may be considered a good sales point, but it is doubtful that forced air circulation has any beneficial effect other than the removal of moisture from the floor under the hover. It is far more important to the health of the chicks that the temperatures be uniform than it is that the air be circulated. Electric brooders in cold, damp climates should have false floors (as discussed elsewhere) to prevent condensation of moisture under the brooder. It should also be remembered that the chickens enter and leave the brooder many times a day. This fact alone has a tendency to displace the air, causing a certain amount of air exchange to take place.

If the purchaser wishes to pay the additional cost for a brooder with a circulating fan over one without, it should certainly not be discouraged. On the other hand, those using brooders without circulating fans should not be made to feel that their brooder is inferior nor that it is necessary to purchase high-priced brooders to get good results.

The purposes of a ventilating fan are to remove moisture, supply fresh air, and to regulate the temperature uniformly throughout

the hover. It can readily be seen that under certain circumstances positive circulation of the air would be undesirable. Such a case might occur when the heating element was defective but the fan continued to operate. Under that circumstance, the temperature under the brooder would be quickly reduced to that of the outside air and the heat from the bodies of the birds would be rapidly dissipated.

G. Suggestions on the Care and Operation of Electric Brooders

(1) Time of Brooding

Brooder operation varies from late winter, spring, and early fall seasonal use to year-round operation in commercialized poultry production. Advice on brooding and other phases of poultry management for localized areas can be obtained from the county agent, the vocational agricultural teachers, state extension poultry specialists, agricultural engineering departments, and from the experimental stations of the state colleges. Successful commercial poultrymen and farmers specializing in poultry production are also a good source of practical information. When starting a brooder program with a cooperative, an effort should be made to obtain information on local experience and methods used with electric as well as other types of brooders.

(a) Spring Brooding

Spring brooding may begin as early as January 1 and extend through July 1. Northern areas will generally start brooders earlier than southern areas because they have better brooder houses. Late springs with cold weather in March have resulted in better equipment which permits brooding to start in January and February. Maximum brooder operation throughout the United States can be expected from March 1 to June 1. Spring brooding is best for pullets that go into the laying house in the fall.

(b) Fall Brooding

Records and experience indicate that the fall of the year is a good time to start chicks. This is due to the comparatively mild weather when the chicks are hatched. In four weeks' time they should be well enough feathered to protect them from early cold snaps. Some records have shown less mortality with chicks started in September than at any other period of the year under comparable brooding methods. The disadvantage of such brooding is that farmers may not find as ready a market for broilers in the fall as for spring brooded chicks. Fall chicks should be ready

for Thanksgiving and Christmas holidays, which should improve the marketing possibilities. There may also be some objection to fall hatched pullets starting their laying period early in the summer. These are matters of local concern and should be thoroughly checked with practical experience previously obtained before fall brooding is widely recommended.

(2) Cold House Brooding

Cold house brooding has been successful in many areas. This means that the brooder house is not heated, the only heat available being that beneath the brooder. This does not mean that the brooder house can be drafty. The house must be well built and wind-proof on all sides. Ventilation should be provided, either by adjustable openings or controlled positive ventilation by electric fans. Ventilation is essential to provide fresh air and to remove moisture in the litter and given off by the chicks in breathing.

In cold climates it is especially important that wind be kept from under the house. This can be done by extending the sides to the ground or banking the sides with earth when the house floor is above ground level.

The practice of heating brooder houses developed largely due to the type of brooders previously available. Brooder stoves that use coal, wood, oil, or gas are so designed that they can keep the entire house at a higher temperature than necessary (unless the fire goes out). In cold weather this tends to increase moisture condensation on the walls and floors. It may also result in slower feather development and less hardy and lively chicks. It is also possible that damp, warm air may be conducive to the spread of colds and disease. Electric brooders are not suitable for heating the entire house because of the expense involved in heating such a large area with electricity. Most electric brooders are insulated to prevent the loss of heat and therefore cannot heat the brooder house. This makes them very economical to operate. Chicks raised in cold houses are generally very lively, feather fast, eat well, and in general do as well or better than those raised in heated houses.

(3) Hover Floor Protection

When using an electric brooder in an extremely cold climate, it may be desirable to place an auxiliary floor under the hover. The floor should be made of tongue and groove lumber, nailed together with one-inch tie strips. This creates a one-inch air space between the brooder house floor and the false floor when the tie strips are placed between the building floor and the false floor. This floor

should extend six to twelve inches beyond the sides of the brooder. This air space between the building floor and the false floor prevents the condensation of moisture under the hover and removes the cause of one of the few complaints against the electric brooder. (Note: The air space prevents the loss of heat in the brooder because the false floor does not get as cold as the building floor. The fact that the false floor is warmer prevents the condensation and deposit of moisture from the warm, humid brooder air. Therefore the brooder is dryer).

(4) Number of Chicks Per Hover in Electric Brooding

Hover dimensions will determine the number of chicks that can be brooded at one time. Winter brooding generally requires more space per chick than warm weather brooding. Many practical farmers and poultrymen find it desirable to limit the number of chickens under one hover to 300 on most farms. The maximum number of chickens brooded in one lot and dependent on one hover for heating should not exceed 500. Losses from unexpected difficulties are smaller when fewer chicks are brooded under one hover. Brooder difficulties due to equipment failure, improper temperature control, killing by rodents, and other hazards are less serious when the chicks are divided into lots of 300. (Note: Commercial poultrymen frequently brood many thousands of chicks together in one building. This is not a recommended farm practice because most practical farmers do not have the time, the help, or the skill to take adequate care of such large flocks of chicks).

(5) Hover and Brooder House Lighting

The use of night lights in the brooder house is desirable. It will reduce crowding under the hover, because some of the chickens will always be out eating and exercising.

With turkeys, night lights will tend to prevent panic and thus reduce losses from suffocation and trampling. Ducks and geese may stampede in the dark and lights will help to prevent their panic. If young poultry have night lights to see, they can eat at night, thus breaking the long hours they are without food.

When all-night lights are used in raising chicks or poults it becomes desirable to provide reliable emergency lighting. Since the young birds have never been in the dark, they become badly frightened when the lights go out. This results in panic which causes them to pile up in corners where many are smothered or trampled to death.

Two things can be done to overcome this hazard. First, the lights can be turned off every night for a short time so the birds become accustomed to darkness and are not so apt to become panicked when a power outage occurs. The other method is to provide a battery with two or three low wattage lamps so that lights can be turned on even though the power supplying the regular lighting system fails. The battery light circuit can be arranged to turn on and off automatically whenever the current failure occurs. This is accomplished by the use of a "power-off" switch that is held in position so the battery lights are turned off as long as the high-line power is on. When the high-line outage occurs or a fuse burns out, the "power-off" switch automatically closes the battery circuit, lighting the low wattage battery lamps. The battery lamps supply just enough light to keep the birds from being frightened into crowding together.

A 6-volt battery and 6-volt lamps should be used to supply sufficient light and to last at least one full night. If a car-type battery is used, a battery charger connected to the brooder house circuit can be used to recharge the battery ready for the next power outage. The recharging should receive the attention of the operator at regular intervals and after a night's use of battery lights to keep the battery in readiness for emergency lighting.

(6) Temperature

Brooder temperature should be set at 95 to 100 degrees Fahrenheit for day-old chicks. This temperature is generally taken inside the brooder at a point at least two inches from the floor and six inches in from the outside edge of the brooder. The hover should be heated for 24 hours or more before the chicks are placed under it. This gives the operator time to see that the equipment is working properly and takes the chill from the area covered by the brooder. Commercial brooders are provided with a thermostat properly located so that the temperature can be checked. Poultry thermometers should be purchased for use with homemade brooders. Starting temperatures for day-old poults is generally about 100 degrees Fahrenheit.

(7) Temperature Control

As the chicks grow and feather, the hover temperature may be lowered. This can generally be done at the rate of 5 degrees F. per week down to 70 degrees F. At the end of eight weeks, no further heat should be required. With young chicks, the heat may be increased in extremely cold weather. After ten weeks of age, no heat should be used in the hover, and low perches should be provided.

This will teach the young chickens to roost and will prevent crowding and smothering.

Wafer type thermostats have a thumb-nut screw to regulate the control. The wafer is filled with gas which expands with heat. Adjustment of the thumb screw determines the point at which the desired temperature operates the snap switch used with this type thermostat.

(8) Special Provision for Young Chicks

Young chicks should be confined rather closely to the hover. Boards, cardboard, or a strip of galvanized iron ten or twelve inches wide may be used as a fence. It should be placed approximately 12 inches from the sides of the hover. It will prevent the chicks straying from the hover and getting lost. Such protection also helps to eliminate floor drafts.

The pilot light of the heating lamps under the brooder may be so bright that the young chicks will not leave the hover because it is somewhat darker outside. They can be taught to leave the hover by placing the feed troughs partially under the brooder and water containers just outside the hover. The fence should be moved away from the brooder a few inches each day. As the fence is moved, the feeder troughs should gradually be moved out from under the brooder until at the end of four or five days they will be completely outside.

In extremely cold weather very young chicks may not leave the hover. In this case the red pilot light in manufactured brooders can be replaced with a white lamp. This will give more light and assist the chicks in finding feed and water placed under the hover during the extremely cold weather.

Some brooders are equipped with red pilot lights and others with white lights. They serve two purposes: first, to attract the chicks to the hover; and second, to prevent crowding underneath. The red lamp is used to prevent cannibalism which may develop after the chicks are four weeks old.

(9) Chick Behavior at Undesirable Temperatures

When the brooder is operating properly, chicks will scatter uniformly under the hover. If the chicks cluster near the center under the hover, the temperature is too low; if they go to the outside edges uniformly, the temperature may be too high. No drafts should be permitted in the

brooder house. A curtain fitted to the sides of the hover may be necessary for chicks in extremely cold weather. The curtain should be raised or removed as the weather moderates and the chicks grow. Some brooders have adjustable legs for raising the hover as the chicks require more and more head room. Excessive cheeping and crowding indicates abnormal conditions unsatisfactory to the chicks. Quiet chicks are contented. Check feed, water, temperature, and drafts when chicks are noisy.

IV LIGHTING FOR EGG PRODUCTION

Many farm flocks produce an average of less than 150 eggs per hen per year. However, with good management and good laying stock, it is not unusual to find flocks that average from 180 to 200 eggs per year or more. Generally flocks will not produce more than 65 percent production at any one time. That is, only 65 out of 100 hens will lay per day. This means that some hens are skipping a day. This is due to the fact that it takes approximately 26 hours to produce an egg, although the better hens produce an egg every 24 hours. For this reason, hens have a tendency to lay fairly early in the morning one day, and two hours later on each succeeding day until the 26-hour period ends after dark. This throws them off egg-laying schedule, and they skip laying that day. The egg laying cycle then starts again after a day is missed.

When hens reach higher than 65 percent production there is considerable danger that slight changes in feeding mixtures, temperature, or water supply will throw them out of production and into a molt, during which time they do not lay. Few poultrymen attempt to force or maintain their hens to a higher than 65 percent production.

A. Night Lighting

The normal heavy egg-laying period is from March 1 to August 1. This laying period is determined by the increased number of hours of daylight. Thirteen or 14 hours of light are sufficient to stimulate the pituitary gland through the reaction of the bird's eye and this results in the egg-laying process. Before this discovery was made someone found that the use of night lights in the fall of the year would cause the hens to lay. This was very advantageous because there has always been excessive egg production in the spring months and a reduced supply from September through January. Normally, the year's egg prices are highest in October, November, and December. Consequently, those people who use night lights to stimulate egg production in the fall are able to make more profit from their chickens. This has now become an accepted and standardized practice. Egg prices still tend to remain high in October,

November, and December. Most poultrymen who make poultry production profitable have found that they must use night lights. (Note: Experimental results do not indicate that night lights increase the flock's annual egg production. They do change the hens' low production period to higher production averages during the winter. Lighted flocks tend to produce less eggs in April, May, and June, which offsets the winter increase and keeps the annual record from rising.)

(1) Amount of Light

Night lighting may be conducted in several ways. It is important to add enough light to increase the stimulation of the pituitary gland and to provide additional time for eating sufficient feed to supply the hen for the increased production.

It is standard practice to provide one watt of light per five square feet of floor space. Less light is needed for all-night lighting than for morning and evening lighting. In the morning there must be sufficient light to get the hens off the roost, and for evening lighting there must be sufficient light to keep the hens from roosting. With all-night lighting, only sufficient light is necessary to enable the birds to see in getting to the feed and water hoppers and back to the roosts. Reflectors should be used to direct the maximum amount of light on the roosts or on the floor as desired.

(2) Morning and Evening Lighting

Lights can be turned on in the morning early enough so that the hens will have at least 13 or 14 hours of artificial and natural daylight. If desired, evening lights can be substituted for morning lights. In this case, some provision must be made for dimming the lights for a few minutes before they are turned off so that the hens will have time to find their way on to the roosts. Morning lighting is advantageous to the cooperative because it does not contribute to the evening demand peak.

(3) All-Night Lighting

All-night lights are preferred by some people for several reasons. First, no dimming devices are necessary to get the birds on to the roosts. Second, all night lights permit the hens to get off the roosts and eat and exercise whenever they desire. Third, all-night lights tend to discourage thieves and rodents. The practice of using lights for over-crowding poultry houses should not be recommended.

When winter or early spring brooding is practiced, lights in the brooder house are especially beneficial because the young chicks are not forced to go without feed during the long, cold nights. Since it is generally accepted to be good poultry management to increase feed consumption to the maximum, the use of lights will assist by giving the chicks more hours of the day in which to consume feed.

(4) Position of Lights

All-night lights are generally so placed and shaded that direct light is kept from the roosts. It is recommended that the lights be hung directly over the feed and water hoppers. For morning and evening lighting, lamps are placed much higher above the roosts. Such lights are permitted to shine on the roosts, because it is desirable to force the hens off the roosts and keep them down on the floor at work.

Reflectors should always be used with lights to direct the light where it is wanted. Reflectors also reduce the size of lamps required to give the desired amount of light. Lamps should be hung high enough to clear the heads of men working about the building.

(5) Control of Lights

Automatic control switches can be installed which will turn the lights on and off at designated hours. However, many farmers will prefer to use manually controlled switches, which for convenience may be placed in the dwelling. Special switches may be installed to permit the dimming of evening lights as previously mentioned.

(6) When to Begin Lighting

Lighting is generally begun the last two weeks in October for early hatched pullets. Lights for old hens are started not later than January. In some cases, lights for old birds are started in late October. Some care should be taken to see that the amount of light per day is increased gradually. This could be done by turning on the lights for half an hour for the first three or four days and increasing the lighting time gradually by 15 minute intervals, until there is sufficient artificial light to make the hens' working day 14 hours long. Sudden changes in the length of the day may throw the hens into a molt and stop egg production.

(7) Cost of Wiring for Night Lighting

The present costs for wiring a 200-hen house will probably range from $35.00 to $50.00. Electric clocks to control lighting may be purchased for $10.00 to $15.00. One clock can probably be arranged to handle larger than 200-hen houses.

V WATER WARMING

A standard dozen eggs weighs 24 ounces. Approximately one pound of this weight is water, which means that 65 percent of an egg is water. Hens that do not have adequate and continuous water supply cannot possibly be high egg producers. Consequently, special provisions must be made by careful poultrymen to see that a never-failing supply is available. Since night lights increase egg production during the winter months, it is necessary to provide a means to prevent the water supply from freezing. This can very readily be done by the use of electric poultry water warmers. There are several kinds of these devices, ranging from those that use an ordinary incandescent lamp as a souce of heat to thermostatically controlled automatic heating equipment.

(1) Immersion Type Heaters

Most poultry supply dealers carry a low-cost immersion type poultry water heater. This unit consists of a small waterproof case, approximately one and one-half inches in diameter, and eight inches long. This case contains a heating element and a thermostat to control the temperature. The rubber extension cord is fitted into the case through a water-tight seal so that the unit can be placed directly in an ordinary water bucket. The thermostat is set at the factory and regulates the temperature between 50 and 55 degrees. That is, when the temperature of the water drops below 50 degrees, the thermostat automatically turns on the current and shuts it off before a 55 degree temperature is reached. The extension cord with which the unit is equipped may be plugged into an ordinary 115 volt convenience outlet. These units consume from 150 to 400 watts, depending upon their size, which is determined by the amount of water they are to keep from freezing. The smaller size is sufficient for a 3-gallon bucket, and the larger unit for a 5-gallon bucket. The amount of operation and the current consumed with the immersion type heater depends upon weather conditions. The cost of immersion heaters will vary from $3.00 to $5.00.

(2) Insulated Box Heaters

Some manufacturers supply an insulated water warming box containing heating elements and a thermostatic control. Elements may vary in size from 500 to 1,000 watts. This box is so made that a sheet metal trough can be set over the heating units, which are generally coiled wires. The trough is filled with water for the hens. The thermostat may be set at a given temperature and the current is turned off and on automatically. Such heaters are generally mounted on a small stand fitted with perches so the hens can roost ten or twelve inches off the ground while drinking. The cost generally varies from $15.00 to $35.00. An extension cord permits the use of regular 115-volt service from a convenience outlet.

(3) Lamp or Element Type Water Heaters

Frequently electric lamps or heating elements are placed under water containers to keep them from freezing. This is very successful if the proper wattage lamp or element is used. When the weather is extremely cold, large wattages may be needed. Such equipment does not have a thermostat to control the current. Consequently, the operation is not as economical as other units.

In some cases, an insulated box or base containing the lamp or element for heating water is constructed. In this case, the water fountain is set in the box immediately over the heat supply. Heat rising from the lamp or element warms the water.

In other designs, an electric lamp is fitted in a water-tight tube inserted in either the top or bottom of the bucket. If placed in the top of the bucket, the tube should be weighted with sand placed on top of the bulb to hold it down in the water and prevent it from floating. The extension cord passes up through the sand and out through the open top of the sheet metal tube. If the tube is inserted in the bottom of the bucket, it requires cutting an opening and soldering the tube in place. Sometimes a tin can is used for the tube. When this is done, the electric lamp is mounted in a porcelain socket on a baseboard and the water bucket set down over the lamp. This permits the heat from the lamp to warm the water in the bucket. Since thermostatic control is not provided, the lamp burns continuously as long as the extension cord is attached to the convenience outlet. In mild weather, a 15 or 20 watt lamp is sufficient. In colder weather, a 40 watt or larger lamp may be necessary.

Manufacturers supply electrically heated fountain type waterers. Such fountains have a compartment underneath the water reservoir in which a heating element and thermostat are mounted. An extension cord is provided for attaching to a convenience outlet.

VI POULTRY HOUSE VENTILATION

Several years ago exhaustive studies were made at Iowa State College on the value of brooder and poultry house ventilation. In this study, several well-insulated air-tight pens were constructed. Each air-tight pen contained the same number of birds of the same breed, all fed, watered, and cared for in identically the same manner. The only variable in these pens was the amount of air supplied to each bird per minute. Air quantities ranged from a fraction of a cubic foot of air per minute to several cubic feet per minute per bird. Strange as it may seem, those receiving the least quantity of air made the best record in egg production, hatchability, and length of life.

Studying the records to see why this unlooked-for result occurred, a clue was discovered in the temperature maintained in the various pens. The pen receiving the least amount of air maintained almost constant temperature throughout summer and winter. This indicated that the birds were living under constant temperature the year round. The birds receiving the largest amount of air had only a slight difference in temperature between summer and winter. This indicated that much of the birds' energy was expended in heating the air that passed through the pen. Obviously the moisture conditions were extremely divergent between the pens receiving the most and the least air per minute. After the pens had been operating for a period of several years, the chickens with the least air in their pens were wringing wet. Those receiving the most air were completely dry. From the results of this experiment it is clear that temperature control is of far more importance than moisture control. This fact should be remembered when over-enthusiastic people recommend elaborate and expensive ventilation control. Positive ventilation should be controlled by a combination humidistat and thermostat to prevent excessive temperature changes in poultry houses.

There are various methods of ventilating poultry houses, depending upon climatic conditions locally. The electric fan is highly recommended because of the exact controls which can be placed on the quantity of air exchanged and the temperatures within the brooder house. Other types of construction and ventilation include the open-front house with a muslin covering to prevent drafts, special roof ventilators with closed and insulated air ducts, and building construction which provides air inlets and outlets at the floor line and the eaves. Ventilating fans may be regulated either by humidistats or thermostats but better control of temperature is obtained when both are used on the ventilation system. When only one control is to be used, present information indicates that thermostatic control is preferable because of the desirability of maintaining a uniform temperature.

Thermostats may be of wafer type, which contain a volatile fluid or gas, the volume of which is affected by a slight change in temperature. In some cases, bi-metal strips are used for temperature control. Humidistats are much more delicate in construction and depend upon the expansion or contraction of hair to record the relative humidity of the air and to activate controls which start or stop the motors.

VII POULTRY HOUSE WIRING

Wiring for the brooder and poultry houses should provide ample capacity for the operation of the brooder, water warming and lighting load. Undersized wires will definitely reduce heating efficiency and may result in serious chick losses. Particular attention should be paid to wire sizes in the feeder line, since brooder houses are frequently long distances from the meter pole.

VIII LITTER (Bedding)

From four to six inches of litter may be necessary in very cold weather. Stirring of the litter every seven to ten days helps to control coccidiosis. (Coccidiosis: A condition produced by an intestinal parasite - Coccidia - spread from chicken to chicken by the droppings.) Some experimental information suggests turning the litter upside down; others limit stirring to the top two inches of litter.

Covering the litter with paper for the first few days prevents chicks from attempting to eat the litter instead of feed.

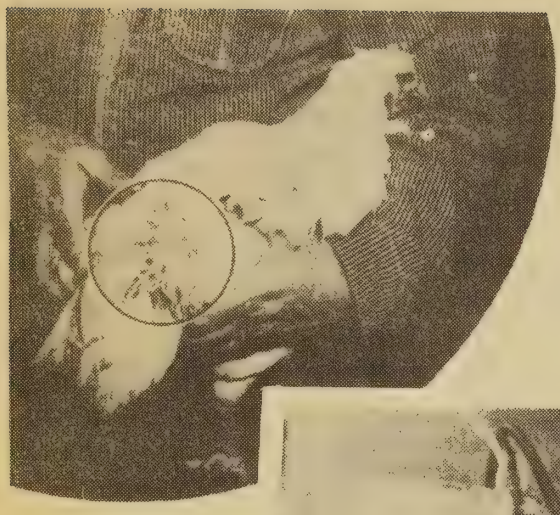
Chopped straw, shredded corn fodder, ground corn cobs, peat moss, cotton seed hulls, sugar cane residue, wood shavings, or sand may be used for litter. Sawdust should not be used because the chicks may eat it and die.

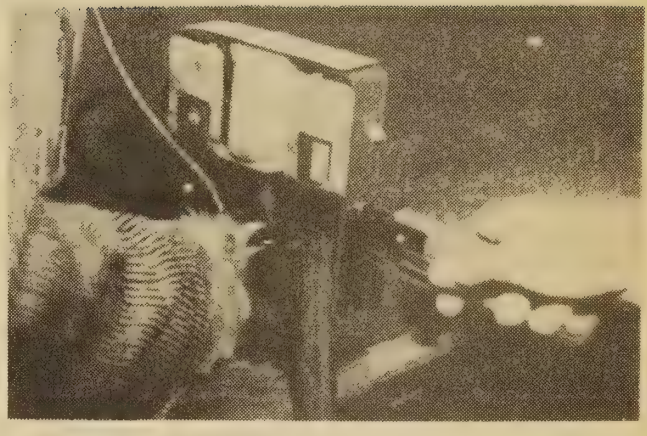
IX ELECTRIC "DEBEAKER" - OTHER ELECTRIC EQUIPMENT

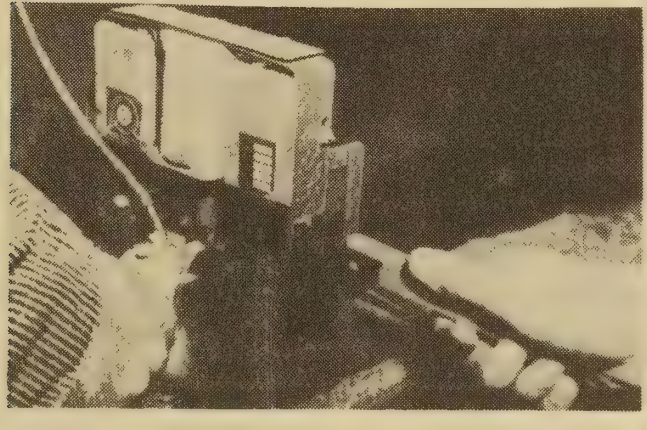
Chickens frequently become cannibals when confined in large numbers. To stop excessive fighting and killing, an electric device has been developed to disarm the birds by burning off one-eighth to three-eighths of an inch from the upper half of the beak. This operation is harmless and apparently painless to the bird. Debeaking is somewhat similar to the shoeing of a horse when a blacksmith burns the hoof with a red-hot shoe to make a firm fit. Burning the beak is a much more satisfactory method than cutting or grinding. The electric "Debeaker" cauterizes the wound, thus preventing blood loss. Cutting with a knife or debeaking with other instruments may result in excessive bleeding. It is also more sanitary and there is little danger of infection when a red-hot blade is used.

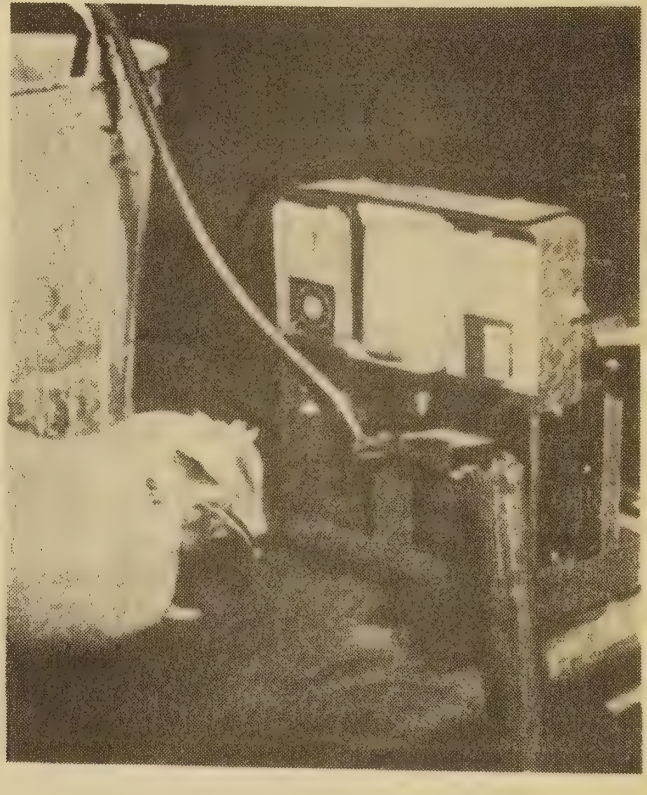
Debeaked birds should be fed poultry mash in containers because they will have difficulty in picking up whole grain from the floor. If whole grain is to be fed, it should also be placed in hoppers so the bird can eat the grain more readily.

Serious cases of cannibalism sometimes occur when the birds are only four weeks old, although as a rule it does not develop until the pullets are confined to the laying house. Various reasons have been listed as the cause of cannibalism, but the habit seems to develop in many cases as the result of fighting and feather pulling. Drops of blood which appear on the feathers or flesh of the bird attract the attention of other birds that peck it from curiosity. When this pecking is severe, the injured bird has a tendency to run and every bird passed takes a peck at the bloody spot. This is especially serious when the habit of cannibalism is well advanced. Many hens in crowded houses are run or pecked to death attempting to get away from the other birds.









Prolapsus, in which the hens literally lay themselves inside-out, is another cause of cannibalism. Birds in this condition are particularly vulnerable to injury from pecking. When the lining of the body cavity is punctured, the birds die within a few hours. There is also considerable evidence to indicate that cannibalism results from feed deficiencies, since birds living on the open range seldom acquire the habit in serious proportions.

A brief examination of the accompanying photographs will indicate the need for and the steps in debeaking. Feather picking has occurred immediately around the base of the tail feathers on the bird illustrated. Feather pulling is frequently the first sign which indicates that cannibalism is developing.

As shown in the illustration, the upper beak of the chicken is curved, making an efficient and dangerous weapon, because it is possible for such a beak to make a serious slashing wound. In order to debeak the bird, its mouth is opened and the upper half of the beak placed in position so that the red-hot bar will cut off the desired portion. When the operation is properly done, the bird's bill will appear as shown in the lower photograph. In this case, approximately one-half inch was taken off. It will be noted that the lower half now projects approximately one-quarter inch beyond the upper half of the beak. In this condition it will be impossible for the bird to do serious damage to other chickens.

Debeaking also results in a saving of 10 to 20 percent in feed. Chickens prefer whole grain to mash, and frequently form the habit of "hooking" or "billing" the mash from the hopper in search of larger particles, using the upper mandible to remove feed. Feed so removed is wasted, because it becomes mixed with the litter. When the bird's beak has been cut off as shown, it prevents wasting so much feed. It is also possible that debeaked flocks fight less after the birds discover that they cannot injure each other. This prevents the loss of feed through wasted energy in fighting and running.

Other uses of the "Debeaker" include the de-winging of day-old chicks and poults to prevent flying. This is done by taking one joint from one wing only. Spurs and beaks of roosters may also be removed to stop fighting. This operation does not reduce hatchability of eggs. Some records indicate that higher fertility of eggs is obtained in flocks where the cockerels are debeaked. The debeaking of chickens and pheasants also breaks the habit of egg eating.

X EGG CANDLERS

Egg producers who plan to take advantage of premium markets by producing high quality eggs will find the electric egg candler of valuable assistance. This device is low in first cost and consumes little electricity. Generally, a 60-watt lamp is used. The candler enables the operator to inspect the eggs, picking out those that contain meaty or bloody spots and undesirably large air cells. The candling lamp reveals the finest of hairline cracks, thus showing up damaged eggs immediately.

The lamp should be placed slightly above the opening in the candler. This prevents too much light passing through the egg. When the bulb is directly opposite the opening, too much light enters the egg. This hides the defect because the light diffuses so much that defect shadows are not visible. From 450 to 900 foot candles of light are found at the opening in various manufactured equipment.

When the egg is candled it should be whirled rapidly to cause the yolk and white to revolve inside the shell. This helps the operator to see defects and assists him in determining egg quality.

Recently a new type of candler has been developed. With the old-style egg candler each egg is picked up and placed in an opening in the lamp container. The light then passes through the egg, showing up any defects. With the new method, a small cylinder is so made that a tiny electric lamp can be screwed in a recess at one end of the cylinder. An extension cord is attached to the lamp socket through the other end of the cylinder. When connected to a convenience outlet, the lamp end of the cylinder is placed on an egg in a tray or container. The strong light from the tiny lamp enters the egg, causing cracks, bloody spots, and some checks to show up. Many more eggs per hour, per worker, can be graded by this method, thus reducing the cost of high quality egg production. However, since the egg is stationary, the yolk and white do not revolve. Therefore, this type candler may cause the operator to miss defects.

XI EGG CLEANERS

A motorized egg cleaner now on the market combines the use of sandpaper and brushes to remove dirt and filth from the eggs. This method of cleaning eggs is better than washing them, because a mechanical cleaner does not spread bacterial contamination over the entire shell as is the case when eggs are placed in water.

Other types of motorized egg cleaners make use of wire brushes, flexible sanding discs, and other similar abrasive devices. A homemade egg cleaner can be made from a small bench grinder. To do this, one or both grindstones are first removed. Several squares

of fine sandpaper or emery cloth are then placed on the shaft between the cone bushings which held the grindstones in place on the spindle and the lock nuts tightened. When the spindle is rotated by an electric motor, the squares of abrasive paper form an effective buffer, which will quickly clean the eggs without breaking the shells when they are held in position and rotated by hand.

In the past, egg washing has been considered undesirable and definitely harmful to eggs which are to be placed in cold storage. Experience indicated that immersing dirty eggs in water permitted moisture and bacteria to enter the egg during washing or later, in storage. Since wash water soon became filthy, many bacteria were deposited on the shell. When these bacteria entered the egg they caused the egg to spoil or to taste bad when cooked after storing.

Since 1945, however, several companies have been selling commercial size egg washers. These are designed to handle several cases of dirty eggs per hour. The designers claim that they have overcome the passage of moisture and germs into the egg by controlling the temperature of both the egg and the wash water. The machines are quite simple but they are designed to eliminate all egg contamination possible. The following standards of operation have been set up to meet sanitary and egg keeping requirements:

A. The wash water must always be at a higher temperature than the egg being washed. Since the water is warmer, this increases the egg temperature, causing the inside of the egg to expand, developing an internal pressure. This pressure results in an outward movement of air or moisture from within the egg during the washing period. This prevents any bacteria from working into the egg through the shell while the washing takes place.

B. Each egg is washed individually in a small compartment with a spray of fresh, clean, warm water. The dirt is carried away by the flow of water, thus reducing the number of bacteria on the shell. Rubber pads gently massage the egg during washing to remove tightly stuck or dried dirt.

C. After washing, each egg passes through a blast of warm air. The hot air dries the egg and reduces the development of any bacteria left on the shell.

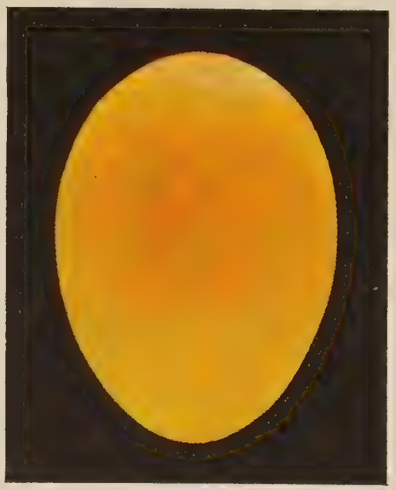
D. The egg then passes through a chamber that is lighted with ultra-violet lamps. The rays kill any bacteria left on the shell. As the eggs pass through the ultra-violet light they are mechanically rotated so that all portions of the egg are exposed to the light.

UNITED STATES STANDARDS FOR QUALITY OF INDIVIDUAL SHELL EGGS

Illustrations of candled appearance of white-shelled eggs showing maximum depth of air cell and outline and position of yolk in each quality

AA Quality

1. Shell—clean; unbroken; practically normal.
2. Air cell—1/8 inch or less in depth; practically regular.
3. White—clear; firm.
4. Yolk—well centered; outline slightly defined; free from defects.

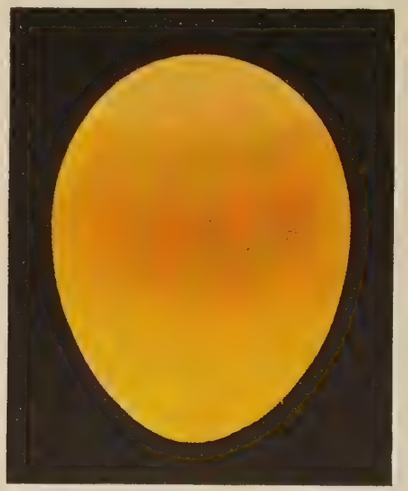


A Quality

1. Shell—clean; unbroken; practically normal.
2. Air cell—2/8 inch or less in depth; practically regular.
3. White—clear; may be reasonably firm.
4. Yolk—may by fairly well centered; outline fairly well defined; practically free from defects.

B Quality

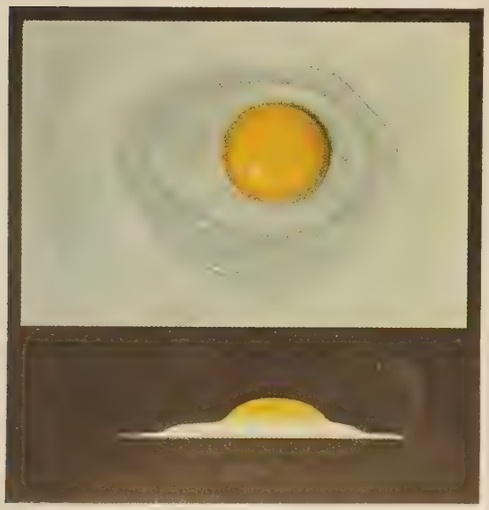
1. Shell—clean; unbroken; may be slightly abnormal.
2. Air cell—3/8 inch or less in depth; may show movement not over 3/8 inch; if not over 2/8 inch, may be free.
3. White—clear; may be slightly weak.
4. Yolk—may be off center; outline well defined; may be slightly enlarged and flattened; may show definite but not serious defects.



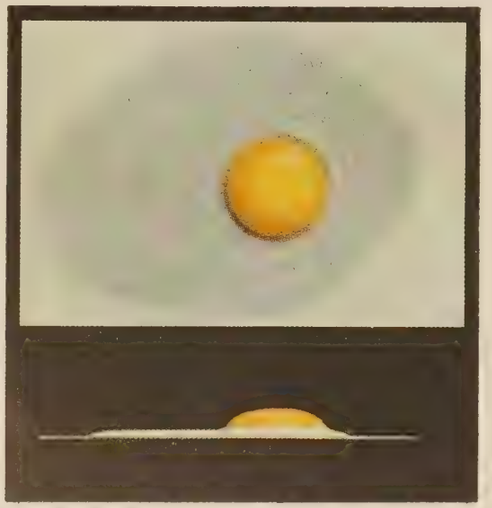
C Quality

1. Shell—clean; unbroken; may be abnormal.
2. Air cell—may be over 3/8 inch in depth; may be free or bubbly.
3. White—clear; may be weak and watery; small blood clots or spots may be present.
4. Yolk—may be off center, enlarged, and flattened; may show clearly visible germ development but no blood; may show other serious defects; outline plainly visible.

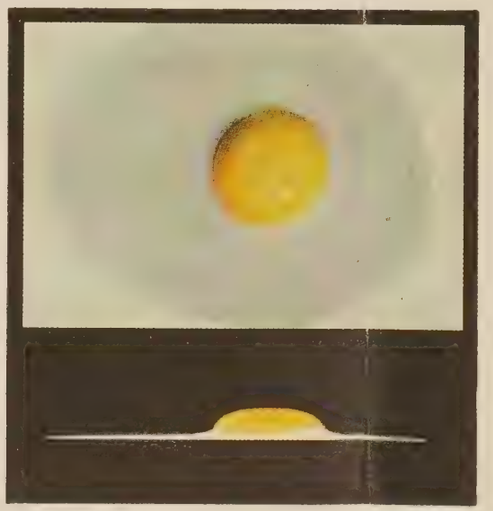
Illustrations of broken-out appearance (top and side views) of each quality—⅓ actual size



AA Egg covers small area; much thick white surrounds yolk; has small amount of thin white; yolk round and upstanding.



A Egg covers moderate area; has considerable thick white; medium amount of thin white; yolk round and upstanding.



B Egg covers wide area; has small amount of thick white; much thin white; yolk somewhat flattened and enlarged.

C Egg covers very wide area; has no thick white; large amount of thin white thinly spread; yolk very flat and enlarged.

Graders should check their work by breaking out an egg occasionally and comparing it with this chart. U. S. Department of Agriculture, Production and Marketing Administration.

U. S. GOVERNMENT PRINTING OFFICE: 1948—741495

Issued February 1948

At present, most mechanical egg washers have very large capacity and are expensive. They are designed for the use of commercial egg buyers. Recently, two companies have placed small egg washers on the market for the use of farmers and small producers of poultry products.

XII MECHANICAL EGG GRADERS

Mechanical egg graders have been on the market for about 10 years. These machines operate with a very small motor of about 1/8 horsepower or less. They are designed to separate the eggs by weight. The machines pick up and move the eggs horizontally with movable fingers and place them on scale pans, each set for a given weight. Eggs of the proper weight trip the pan, releasing the eggs into a compartment. Lighter eggs will not trip the release and are picked up and moved to the next lighter weighing pan. There are as many pans and compartments as classes or weights of eggs per dozen desired. The operation is fast and continuous, one machine handling several cases an hour.

The operator feeds the eggs into a sloping runway and they roll down into position to be picked up and moved across the series of weighing pans automatically. In some models a bright light shines through the sloping runway so the operator can candle the eggs as he feeds them into the machine. This equipment is primarily for the use of very large egg producing and grading plants.

Shell eggs are classified by weight for sale to the consumer. Weight per dozen is based on the total weight of the 12 eggs. Individual eggs may be as much as one ounce lighter per dozen. The weight classes are named and unit weights shown in the following table:

U.S. Weight Classes for Consumer Grades for Shell Eggs
(Applicable to all Consumer Grades)

Size or Weight Class	Minimum Net Weight Per Dozen	Minimum Net Weight Per 30 Dozen	Minimum Weight For Individual Eggs at Rate Per Dozen
	Ounces	Pounds	Ounces
Jumbo	30	56	29
Extra Large	27	50½	26
Large	24	45	23
Medium	21	39½	20
Small	18	34	17
Peewee	15	28	--

Shell eggs are also graded by quality for sale to the consumer. The following specifications indicate the quality requirements for individual eggs which make up the dozen.

Refer to the color chart to find the specifications for quality of individual eggs. A certain tolerance is permitted in setting the quality of a dozen eggs or a case of eggs. The following table will indicate the permissible variation in individual eggs.

Summary of Specifications for U.S. Consumer Grades for Shell Eggs

U.S. Consumer Grades	At Least 80% (Lot Average)1/ Must Be	Tolerance Permitted 2/	
		Percent	Quality
Grade AA	AA Quality	15 to 20% Not Over 5%3/	A B,C, stained or check
Grade A	A Quality or Better	15 to 20% Not Over 5%	B C, stained or check
Grade B	B Quality or Better	10 to 20% Not Over 10%3/	C, or stained dirty or check
Grade C	C Quality or Better	Not over 20%	Dirty or check

1/ In lots of more than 30 cases, no individual case may fall below 70% of the specified quality and in lots of 30 cases or less the 80% minimum requirement shall apply to each individual case.

2/ Within tolerance permitted, an allowance will be made at receiving points or shipping destination for 1/2% leakers in Grade AA, A, and B and 1% in Grade C.

3/ Substitution of higher qualities for the lower qualities specified is permitted

XIII EGG COOLERS

The purpose of an egg cooler is to reduce the temperature of an egg from body heat to as low as practical before it is marketed or placed in a refrigerator or storage room (to about 50 to 60 degrees F). Cooling is accomplished by blowing air through the eggs placed in an open mesh wire basket. As a rule, two or more baskets are set into openings in a frame or box. The box has a circular opening at one end. An electric household fan is set in this opening, blowing air into the box and escaping out through the wire baskets, cooling the eggs. In dry, hot weather, a humidifying device is used. The evaporation of water cools the air, thus lowering the temperature of the eggs and reducing evaporation of water from the eggs. (See attached leaflet).

MAKE YOUR OWN

EGG COOLER

AN ELECTRIC FAN, SOME LAMP WICKS AND LUMBER ARE ALL YOU NEED. SEE REVERSE SIDE FOR BUILDING PLANS.

Losing money because of egg spoilage?

High temperatures flag "danger" in egg production. Eggs must be gathered frequently, cooled at once, and kept cool to prevent interior deterioration, growth of the embryo and loss of weight. Cooled eggs grade consistently higher than improperly-cooled eggs.

This is another strategic sector of the farm front on which electricity can do a job for you and your pocketbook. You can cool eggs electrically at very little expense.

Proper cooling of eggs requires a constant motion of air through the eggs and sufficient moisture to maintain high humidity. Movement of air also tends to prevent mold, an enemy of egg freshness.

There are several types of mechanical egg coolers, differing widely in the method of cooling and in the type of absorbent material used to moisten the air in front of the fan or other air-stirring device.

Here are plans for an electrically-operated egg cooler, that you can build cheaply and quickly. It will help you to cool your eggs easily, and at low cost.

The plans suggest lamp wicks as an absorbent material. However, many egg producers have found burlap effective because its open texture permits a greater passage of air. Excelsior, cotton or other matting materials may also be used.

Eggs may be placed in the cooler in baskets, cases, pails or cans with perforated bottoms, or other containers that permit free movement of air.

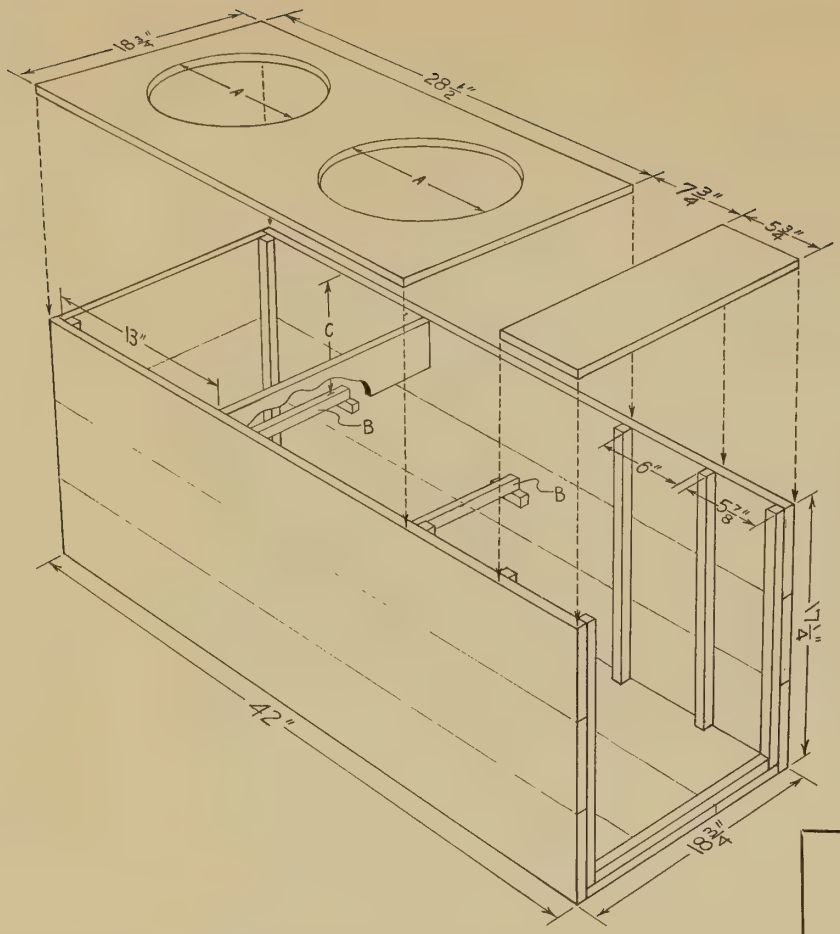
Cost of operating this cooler is negligible. A fan of household size is large enough to use in a cooler, can be operated at a cost of only a few cents for 24 hours.

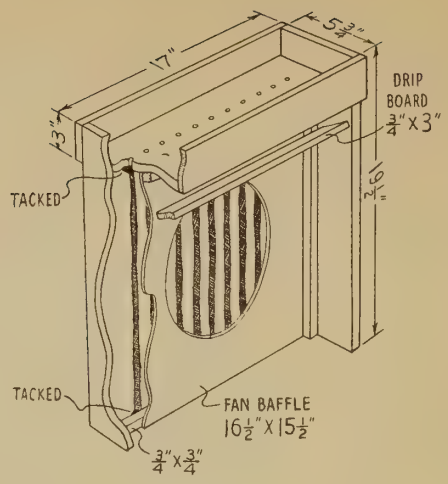
Eggs are highly perishable products. It is risky to collect them infrequently, store them in a warm place and market them only at odd intervals.

You'll get higher grades and hence better prices if you cool them at once and keep them cool until they leave your farm.

Egg Cooling . . . Prevents deterioration, maintains quality and amount of egg checks.

RURAL ELECTRIFICATION ADMINISTRATION, U. S. DEPARTMENT OF AGRICULTURE





BUILD THIS EGG COOLER —IT'S EASY!

Obtain These Materials

Cabinet	LUMBER	Use
Six	¾" x 5¾" x 42"	Sides
Three	¾" x 5¾" x 42"	Bottom
One	¾" x 3" x 17¼"	Brace for top
One	¾" x 5¾" x 18¾"	Section of top
Three	¾" x 5¾" x 17¼"	Back
Trough		
Two	¾" x 3" x 17"	Sides of trough
Two	¾" x 5¾" x 19½"	Ends of trough
One	¾" x 5¾" x 15½"	Bottom of trough
One	¾" x 3" x 15½"	Dripboard
One	16½" x 15½"	Fan baffle

In addition, obtain 24' of ¾" x ¾" stock for corner braces, guards, cleats, supports and other small pieces as indicated.

PLYWOOD OR WALLBOARD

One	¼" x 18¾" x 28½"	Section of top

Lamp wicks as needed.

Plywood or other insulating board may be substituted for ¾" lumber in sides and back of cabinet.

CONSTRUCTION

Assemble the box according to the drawings, leaving the fan end open so the fan may be readily removed for use elsewhere when the cooler is not in use.

The size of the openings A in the cabinet top should correspond to the diameter of the egg container three inches below its top. The distance C between container supports B and top of box should be equivalent to the distance from the bottom of container to a point three inches from its top. This allows the container to fit snugly in the opening, and prevents the cooled air from escaping around its sides.

The trough and wick unit is built separately so it may be removed when the cooler is not in use. By removing the unit the cooler may be kept dry, reducing danger of warping.

Cut the opening in the baffle plate the same diameter as the fan blades and use enough lamp wicks, spaced one inch apart, to cover the fan opening. Drill one-fourth inch holes in the bottom of the trough to correspond with the number of wicks required. Wicks should be hung on the side of the baffle plate opposite the fan. Tack the folded ends of wicks over each hole, and fasten the lower ends to the bottom baffle support, below the fan opening. The speed of evaporation will vary with the size of fan used, humidity and room temperature, therefore it may be necessary to reduce the flow of water to the wicks. This may be done by stuffing bits of rag into the holes. Wicks should be damp their entire length, but water should not drip from them.

Time of Cooling

Eggs will cool thoroughly in from one to four hours, depending on humidity, temperature, and other local factors. When eggs are thoroughly cooled, they should be stored in a cool place, preferably in a refrigerator, until they are marketed.

Buckets or Baskets

Wire mesh egg gathering baskets may be used in the cooler, or a satisfactory substitute may be made by soldering a half-inch or larger mesh wire screen bottom into old milk pails. Any container which permits air to flow readily between the eggs is satisfactory.

This egg cooler was devised as a modification of plans published by the University of Missouri.

(Reprinted from the Rural Electrification News)

U. S. Govt. Printing Office

When eggs cool down from the body temperature of the hen, germ development in a fertile egg does not cease until the temperature is around 68 degrees Fahrenheit. Once the eggs have been cooled well below 68 degrees Fahrenheit germ development does not start again until about 80 degrees Fahrenheit. Poultry specialists recommend that eggs be gathered several times daily and immediately cooled. The REA homemade egg cooler is designed to reduce egg temperature to less than 68 degrees Fahrenheit. This should be accomplished in two or three hours, depending on climatic conditions.

If lower egg temperatures are desired, a large household refrigerator (i.e. 8 to 10 cubic feet), can be used to advantage. Most household refrigerators maintain temperatures around 40 degrees Fahrenheit. One shelf could be reserved for egg cooling. The eggs should be placed directly on the wire shelf or in an open wire rack resting on the shelf. The eggs would then be rapidly cooled to 45 or 50 degrees Fahrenheit, the time depending on the temperature of the eggs when put in the refrigerator and the refrigerator temperature control setting. Generally, the eggs' temperature will drop from 65 to 45 degrees Fahrenheit in four or five hours. They should then be removed and placed in cooled egg crates and stored in a damp basement or cellar at about 50 degrees Fahrenheit until they can be marketed.

Eggs should not be put into warm crates because the eggs' temperature will be raised. Consequently, empty crates should be stored in the basement until needed.

When cold eggs are removed from the refrigerator they should go immediately to the coolest storage room available. Otherwise, the moisture will gather on the cold eggs and provide a medium for bacterial development. If this should occur, the bacteria may enter the egg, causing deterioration or spoilage during the time the eggs are held on the farm. Later, the eggs may be placed in commercial cold storage and the bacteria would have time to seriously damage egg quality. (See Reference No. 34.)

XIV ELECTRIC CLOCKS

Electric control clocks for turning various appliances off and on at predetermined times are available. The most common use on the farm is for poultry house lighting. These clocks range from those having simple on and off controls to very elaborate controls that operate a variety of equipment on several circuits. In some cases, adjustments can be made to turn one device off and on several times a day as desired.

In most cases the clocks have a 24-hour dial with "noon" and "mid-night" A.M. and P.M. clearly marked. As a rule, the 6 P.M. to 6 A.M. hours are placed on a black background to indicate the night hours. The clock is set by turning the dial face in a clockwise direction until the time of setting appears at the indicator arm. The switch control tabs are movable and can be rotated around the dial face until the desired switch operating times are reached. From two to six or more control tabs in some models can be placed on the dial at the desired location. As the dial turns, the tabs arrive at the time indicator pointer and trip a switch arm, causing the electric circuit under control to be opened or closed as necessary.

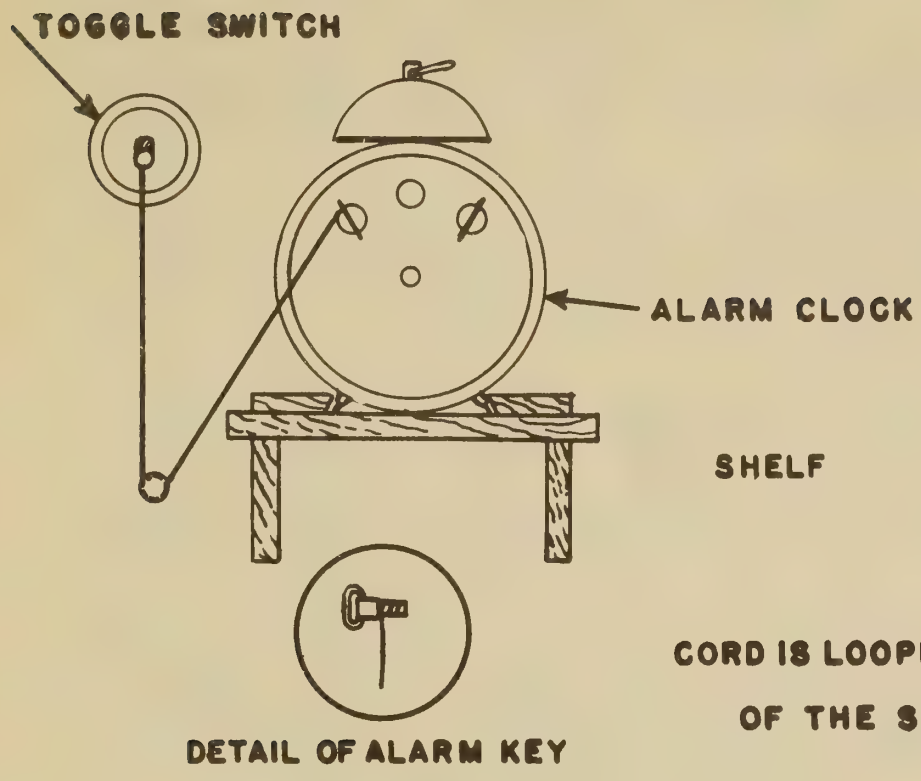
In some case, a thumb screw is used to control the clock dial. In other cases, the operator grasps the dial and turns it directly to set the time. Some clocks have a single switch arm and an indicator which shows whether the switch is off or on. Others have an "off" switch arm and an "on" switch arm which are operated by "off" and "on" tabs properly located.

One clock used for very accurate timing has a minute dial as well as a quarter hour and hour markings on the dial for accurate setting. When evening lights are used, the hens must be given time to get on the roosts before it is completely dark. Otherwise, they will stay on the floor or pile up in the corners. To do this, the lights are dimmed and generally two circuits are required. The "dim" circuit has either smaller bulbs or fewer bulbs which greatly reduces the amount of light, thus causing the hens to get on the roosts. After a few minutes, the "dim" circuit is shut off for complete darkness. Morning or all-night lighting methods do not require a dimming circuit. Some operators use dim lights in the morning for a few minutes to prevent startling the birds when the lights first come on.

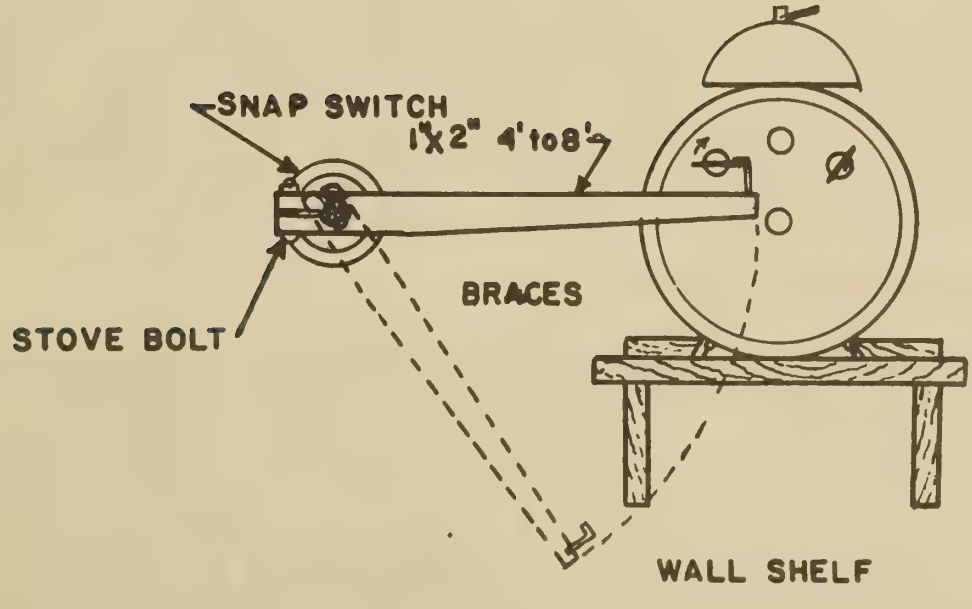
XV POULTRY PICKERS

The chief advantage of the poultry picker is the saving in labor and time required to pick a number of chickens. The picker consists of a revolving drum on which rubber fingers are mounted. This drum revolves at approximately 600 revolutions per minute, the speed depending on the manufacturer's design. In some cases,

ALARM CLOCK TIME SWITCH



CORD IS LOOPED OVER LEVER OF THE SWITCH



speed is varied because of the kind of fowls to be picked. Birds are first scalded and then held in position on the ends of the revolving rubber fingers. This causes a wiping action which removes all of the feathers, including the pin feathers. Skilled operators can pick a bird in approximately 10 seconds. As a general rule, the large wing and tail feathers are pulled out by hand. Bare-backed birds, or those having large numbers of pin feathers, can be picked just as rapidly as birds with fully developed feathers, since the action of the rubber fingers is strong enough to force the pin feathers from underneath the skin. There is no danger of bruising the flesh of birds when using the poultry picker. Bare-backed birds are not penalized in price when picked by machine because no pin feathers remain.

Different types of fingers have been developed for different picking requirements. Short, stubby fingers, approximately 5 inches long, are used for chickens. Slender, whip-like fingers, 18 to 24 inches long, are used for turkeys. This equipment is frequently placed on vertical drums which cause the fingers to extend horizontally as they revolve. Drums are mounted in pairs approximately 30 inches apart. An overhead travelling chain, to which the dead turkeys are fastened by the feet, carries them between the drums. The body feathers are removed by the whipping and wiping action of the long rubber strips. Wing and tail feathers are removed by a roller-type device similar to a clothes wringer in design and action. After the body feathers are removed, an attendant holds each wing in place so the rubber rollers pull out the heavy wing feathers. Tail feathers are removed by hand or with the help of the rubber rollers.

Some semi-automatic pickers make use of electric eyes to start and stop a strong gas flame as the birds move through the singeing area. As the birds move on the supporting chain, they pass through the beam of an electric eye. The interruption of light causes the gas flame to be turned up. The blast of fire and hot gases singes the fine hair and down from the bird's body. When the singed bird passes through the light beam from a second electric eye, the gas is turned down, reducing the consumption of gas and thereby lowering the processing cost.

XVI AUTOMATIC POULTRY FEEDERS

Automatic devices for feeding poultry have recently been developed. This greatly simplifies the work and time required to care for a large number of birds. Most designs make use of a large hopper to hold the mash, and an electric motor to drive an endless chain. The chain is placed in a sheet metal trough having a flat bottom about 3 or 4 inches wide, with straight sides 3 inches high. The sides are bent inward one-half inch at the top to prevent the seed from wasting. The feed trough is placed on the floor or raised a few inches, depending on the age

of the birds. The trough is made of galvanized sheet metal and in sections 4, 6, 8, 10, 12, and 14 feet in length. Corner sections are provided so a square corner can be turned. All corners and trough sections are fitted to join together in various lengths and shapes. Sprockets are mounted at the corners on which the chain travels. These prevent the chain from binding or wearing the trough at the 90 degree turns. Cover sections are provided for the corners to prevent loss of feed.

The chain travels at 8 to 16 feet per minute, depending on the total length of the feed trough and the number of birds to be fed. The hopper has a combination mixer and force feed that causes the mash to flow through an adjustable opening. The feed chain is driven by a motor varying from one-third to one-half horsepower. Larger motors are not required on most automatic poultry feeders. A gear reduction device or "V" pulleys are used to obtain the proper machine speed. Thousands of chickens can be supplied with feed in no more time and with no more labor than is required for a man to dump the sacks of feed in the hopper. This eliminates considerable labor in caring for large flocks of chickens.

The unit runs continuously or intermittently as desired when the necessary controls are used. One unit observed was connected to the time clock that controlled the lights. When the lights came on in the morning, the feeder also began to operate. Since this particular house used lights continuously for 16 hours per day, the unit could be connected to the light control. In other situations, the feeder would require a separate control.

XVII RADIANT HEAT FOR POULTRY HOUSES

The application of radiant heat to warm poultry houses is a recent development. The purpose of heating the poultry house is to reduce the loss of chicks and to keep the floor dry. This idea is directly opposite to cold house brooding. The warm house with a heated floor will tend to increase condensation on the walls and ceilings. If air circulation and ventilation are properly balanced, the condensed moisture may be removed under favorable climatic conditions. The methods of floor heating now employed are very expensive to install and the method is too new to be recommended. The amount of qualified research that has been done on this subject to date is limited. The material reviewed by REA to date does not indicate that the benefits justify the cost of installation and operation. Additional research work on this problem by qualified agencies is necessary before final conclusions can be reached on the value of radiant heat for the farm flock.

Radiant heat is that accomplished by the invisible infra-red rays which transmit heat through space. Such radiant heat travels from stoves, radiators, or any surface which is warmer than the surrounding atmosphere. Poultry house heating by radiant energy can make use of several methods of producing heat. In a few cases,

electric soil heating cable has been used experimentally. The cable is laid on the floor of the house and covered with one-half inch wire mesh on wooden frames to keep the cable from being damaged. Litter is then spread on the wire floor. In other cases, the cable is covered by a thin layer of concrete or asphalt. The current is controlled by a high voltage thermostat or a low voltage thermostat and electric relay as desired. The chief purpose of this method is to dry the litter and to raise the temperature of the floor and building a few degrees. The results in egg production and improved health of the birds has not been sufficient to justify the cost. It would seem more reasonable for the farmer to use ventilating fans to control moisture in poultry houses.

When radiant heating is done by circulating hot water through pipes buried in a concrete floor, the water is generally heated in a coal- or oil-fired furnace and an electric motor used to drive a circulating pump. The motor is controlled by a thermostat to regulate the floor and house temperature. Either copper tubes or galvanized iron pipe is placed at regular intervals across the floor and is covered with concrete, asphalt, or wire mesh on wooden forms. In all cases, installation costs are very high.

XVIII FEED MIXERS

Mechanical feed mixers can be homemade, or manufactured products are available. These range from small mixers holding 100 pounds to large mixers holding 2,000 pounds or more. The average farm mixer would vary from 500 to 1,000 pounds capacity. These units are generally powered with a fractional horsepower motor. "V" belts and pulleys are generally used to transmit the power. The unmixed feed is dumped into a small hopper just above floor level. The feed is elevated to the top of the mixer which serves as both an elevator and a mixer.

The mixing chamber is shaped like a large funnel with the elevating helix in the center. The feed slides down the sloping sides of the mixing chamber. At the bottom it is caught by the elevator, raised to the top, and thrown out in a uniform layer into the hopper. Repeated action of this type quickly mixes all of the ingredients thoroughly. After the feed is mixed, it flows by gravity into bags for transportation to the feeding area.

XIX FEED GRINDERS

This subject will be fully discussed and studied in a feed grinding school. However, feed grinding for poultry is important because it can save the members considerable money by enabling them to grind coarse feeds to obtain better balancing of home-produced feed. The chief value of grinding for chickens is to obtain a feed into which other necessary ingredients can be mixed, a well-balanced ration obtained, and the chickens forced to eat all the food elements when the mash is fed.

There are two general types of feed grinders. One, the buhr or plate type mill, and the other, the hammer mill. Plate type mills are slow-speed and require less power to operate the mill. Therefore, more of the power of a given size motor is expended on the actual grinding. There is some claim that the grain is excessively heated when fine grinding is done with plate mills. A more valid disadvantage is the damage done to the grinding plates when foreign objects get into the mill. Plates will break. Special spring releases and other devices are used to prevent as much breakage as possible.

Coarse, medium, and fine grinding is determined by the type of plate facing and the pressure on the plates. One plate is stationary, as a rule, while the other revolves. Plates are classified as coarse, medium, fine, and double-faced for very fine grinding. The capacity of the mill decreases in pounds per hour the finer the grain is ground. Manufacturers claim that plate type mills produce more uniform grinding with less dust than is produced with hammer mills. There are many small plate type mills which can be operated satisfactorily on single-phase motors of 10 horsepower and less in size.

Hammer mills are high-speed machines. They require a higher percentage of the power of a given motor to rotate the hammers. Consequently, less power is available for the actual grinding. On the other hand, hammer mills are very rugged and are seldom damaged by foreign material in the feed. Fineness of grinding is determined by the size of the holes in the grinding screen. The operation of a mill is such that the kernels of grain are struck by the hammers which revolve on a shaft at 3,000 to 5,000 R.P.M. When struck by the hammer, the grain kernel is broken and flies against other hammers and the grinding screen. The pieces that are small enough pass through the screen. The larger pieces are either broken smaller by impact with the screen or they fly back and hit the hammers again. This repeated hammering eventually breaks all the grain into fine enough particles to pass through the screen. When desirable to change the size of material passing through the mill, the screens can be exchanged quickly and easily after the mill is stopped. Hammer mills are high capacity but, like all mills, the capacity per hour is reduced as the grinding gets finer.

Electric motor power should not be used on hammer mills unless the mill is specifically designed for electric power. Hammer mills designed for tractor power are not suitable for single-phase electric motor drive. One manufacturer produces a one horsepower hammer mill for electric power. It is very satisfactory and should be used by more farmers. It is comparatively low in first cost. While it is small, it can operate on a semi-automatic basis over a long grinding period and therefore can compete successfully with large mills.

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